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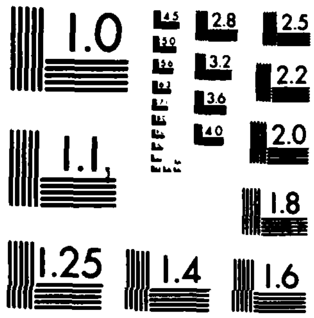

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TERMINAL FORECAST REFERENCE NOTEBOOK

FOR

RAMSTEIN AB, FRG

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PUBLISHED BY
DETACHMENT 2
31ST WEATHER SQUADRON
2ND WEATHER WING (MAC)
UNITED STATES AIR FORCE
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CHAPTER 1

LOCATION AND TOPOGRAPHY

1-1. Ramstein Air Base is located about 50°N and roughly corresponds to a point in Saskatchewan, Canada just north of the American border (Fig. 1-1). The climate in Germany however, is a unique blend of elements with a character all its own and is often surprising.

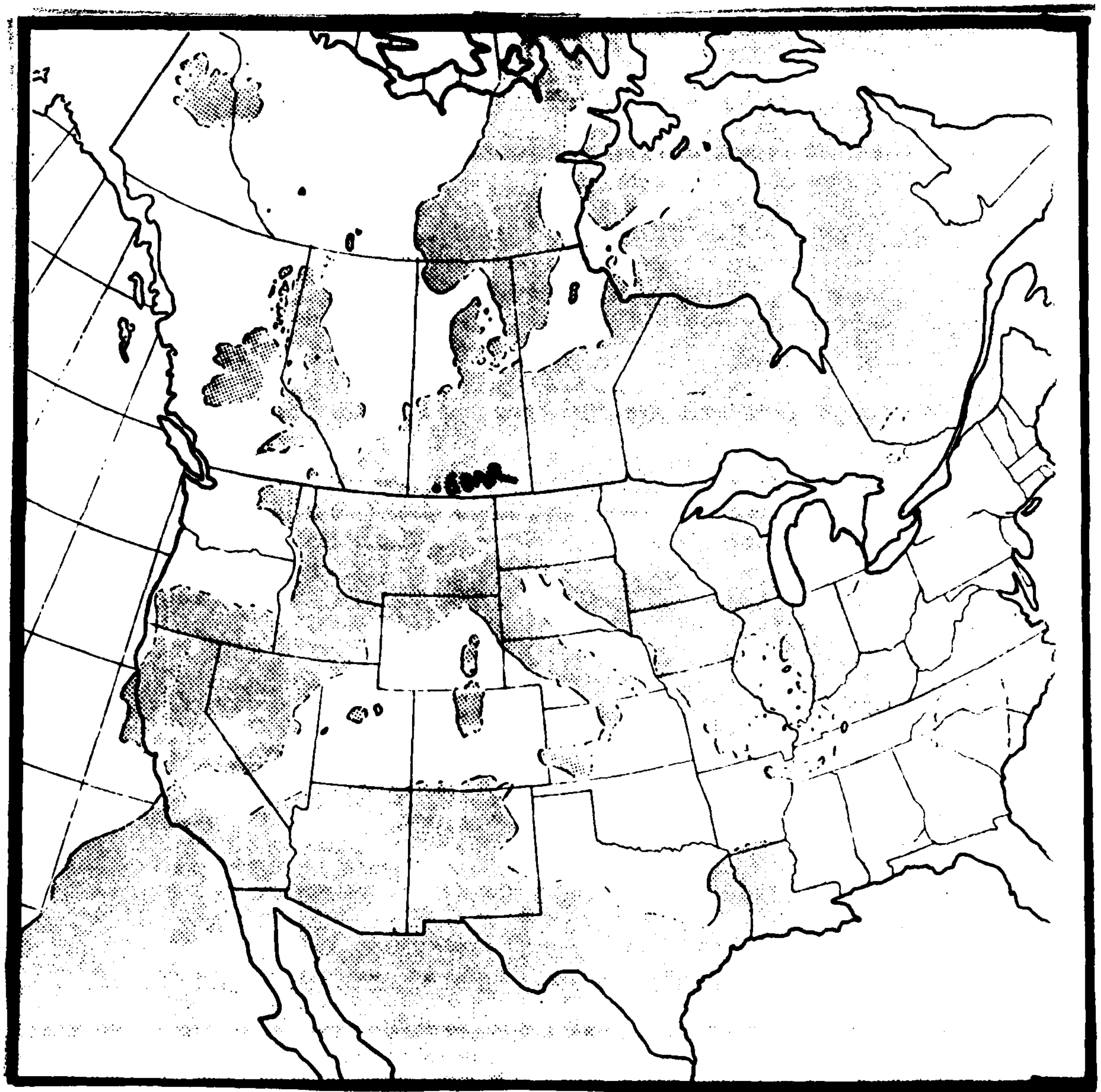


FIGURE 1-1 LATITUDINAL AND AREAL COMPARISON OF EUROPE AND NORTH AMERICA

1-2. Located in the south central plains region of Europe, (Fig. 1-2) Ramstein AB lies on the floor of a small valley orientated WSW--ENE. This valley eventually opens into the much broader Rhein river valley 42NM to the NE. The terrain around the runway elevation of 782ft. rises east to a few points above 2000ft. and south to 1900ft. Hills to the north range up to 1500ft. and to the NW the rise is more gradual and irregular, but at a distance of 60NM the Moselle Mountains rise to an elevation of 3500ft (Fig 1-3).

1-3. The terrain surrounding Ramstein has an influence on many types of weather significant to flying operations. The single most important phenomena affecting flying at Ramstein is fog. The hills flanking the runway complex about 3NM to the SE-S and 5NM to the NW-N are mainly forest areas. At times these hills can be a source of cold air. After sunset cool air starts draining down the hillsides into the valley and unless something disturbs this process, it will continue throughout the night until the entire floor of the valley is filled with a shallow pool of cool air. This drainage effect then diminishes and the radiational effect begins to dominate. The actual speed of fog formation and thickness will vary depending on general conditions but the ideal situation would be for rain to have fallen the previous day, with overcast skies clearing during the early evening, light or calm winds and a moist stable air mass over the station. This is one of the classic Ramstein fog situations and is further aggravated by somewhat swampy conditions at the west end of the field. Visibility will often fall below minimums and persist until well after sunrise. Sunrise usually begins the process of lifting and burning off the fog and generally after the fog breaks cumulus or stratocumulus clouds will form in the afternoon. In winter, lack of daytime heating and morning stratus tend to make fog more persistant and often, especially in winter, a persistant pool of cold air will settle in the valley. Under clear or partly cloudy skies fog may form but at some time during the night a critical frost point temperature will be reached and visibilities will improve sometimes from a few tenths of a mile to several miles. In this situation sunrise has exactly the opposite effect. Insolation will begin to melt the frost releasing moisture back into the atmosphere and the visibility will drop at times to below minimums and not improve until well into the afternoon.

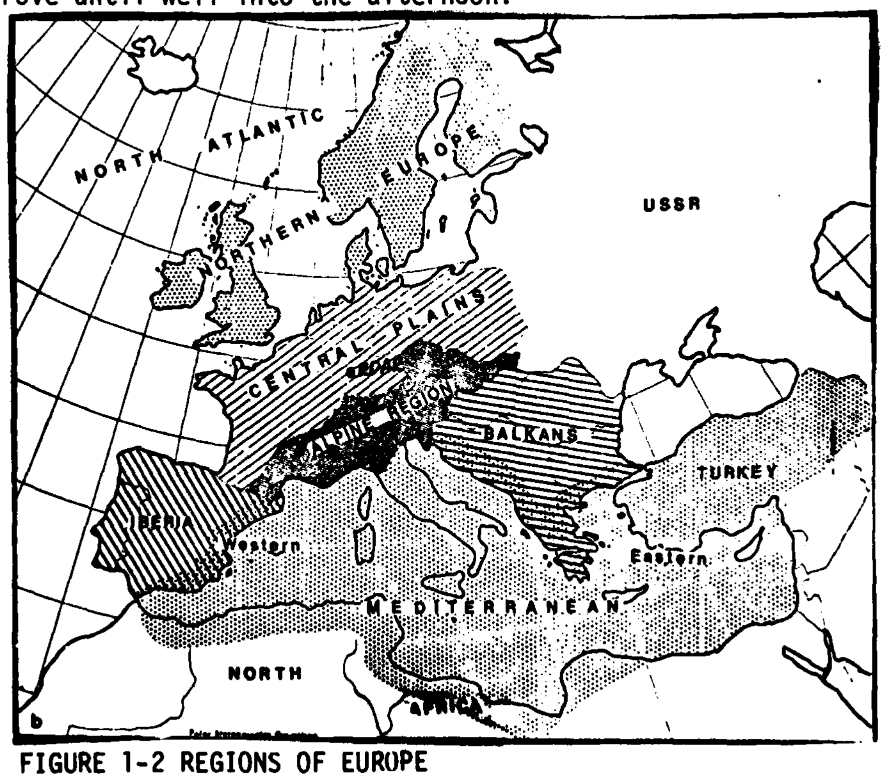


FIGURE 1-2 REGIONS OF EUROPE

MAJOR TERRAIN DIFFERENCES WITHIN 100NM

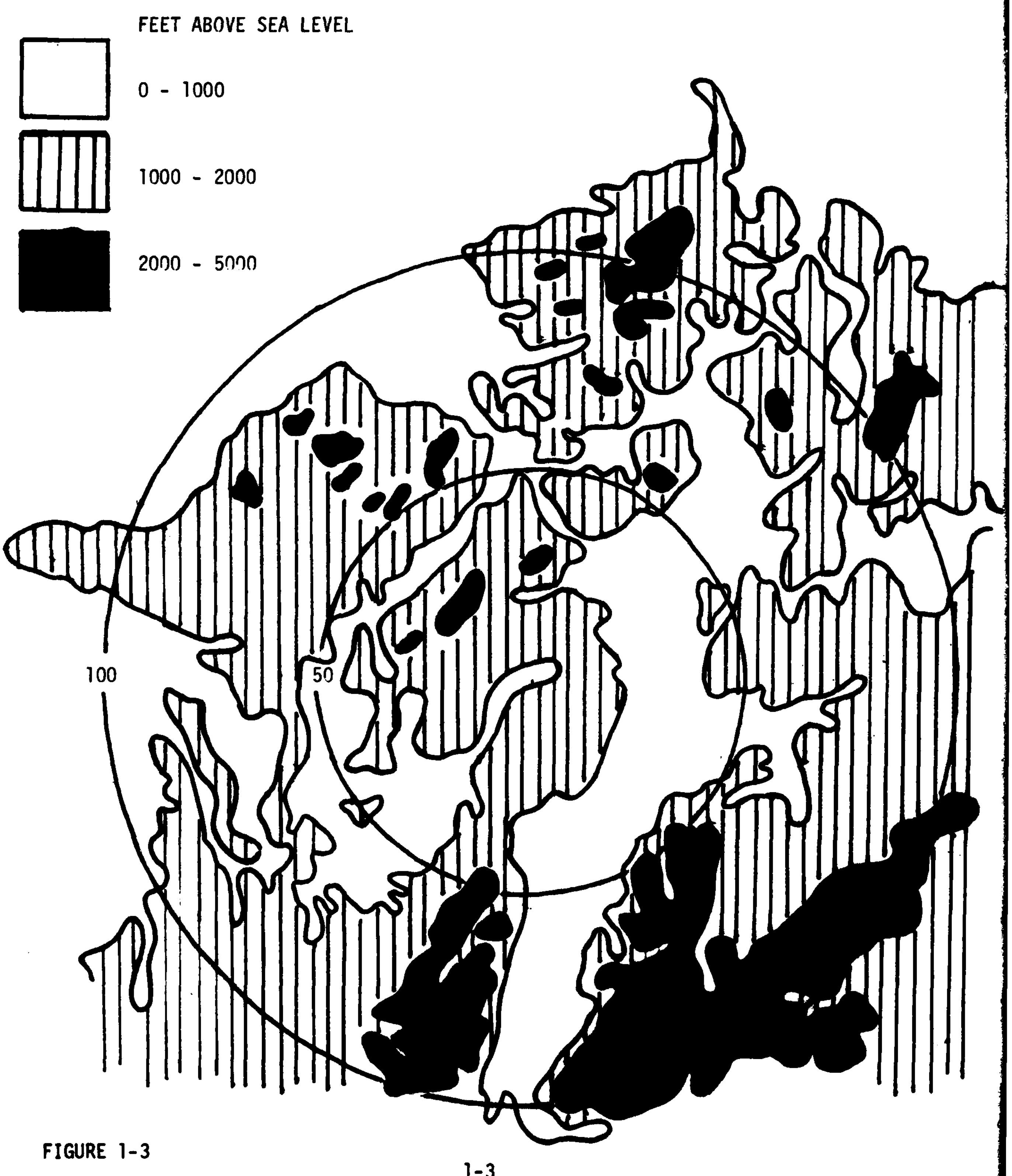


FIGURE 1-3

1-4. Within 30 miles both east and west lie large cities which are at times sources of atmospheric pollution (Fig. 1-4). To the east the industrial Rhine river valley provides large source of pollutants when the flow over the station is easterly. An easterly flow over Ramstein is most often associated with a cold dome extension of the great Siberian high in winter or a migrating cyclone in summer. During an outbreak of the Siberian high the cold dome of air may only be 2000-3000ft. thick and above this level the prevailing windflow may shift to the west or southwest creating warm overrunning intensifying the inversion. Fog will often persists 36-72 hours or longer with little improvement in visibility. This situation requires a frontal passage or cold flow aloft to break the inversion before improvement can be expected. If easterly flow extends up to the 500mb level not only is fog more persistant but the haze layer may reach heights between 5 and 10 thousand feet.

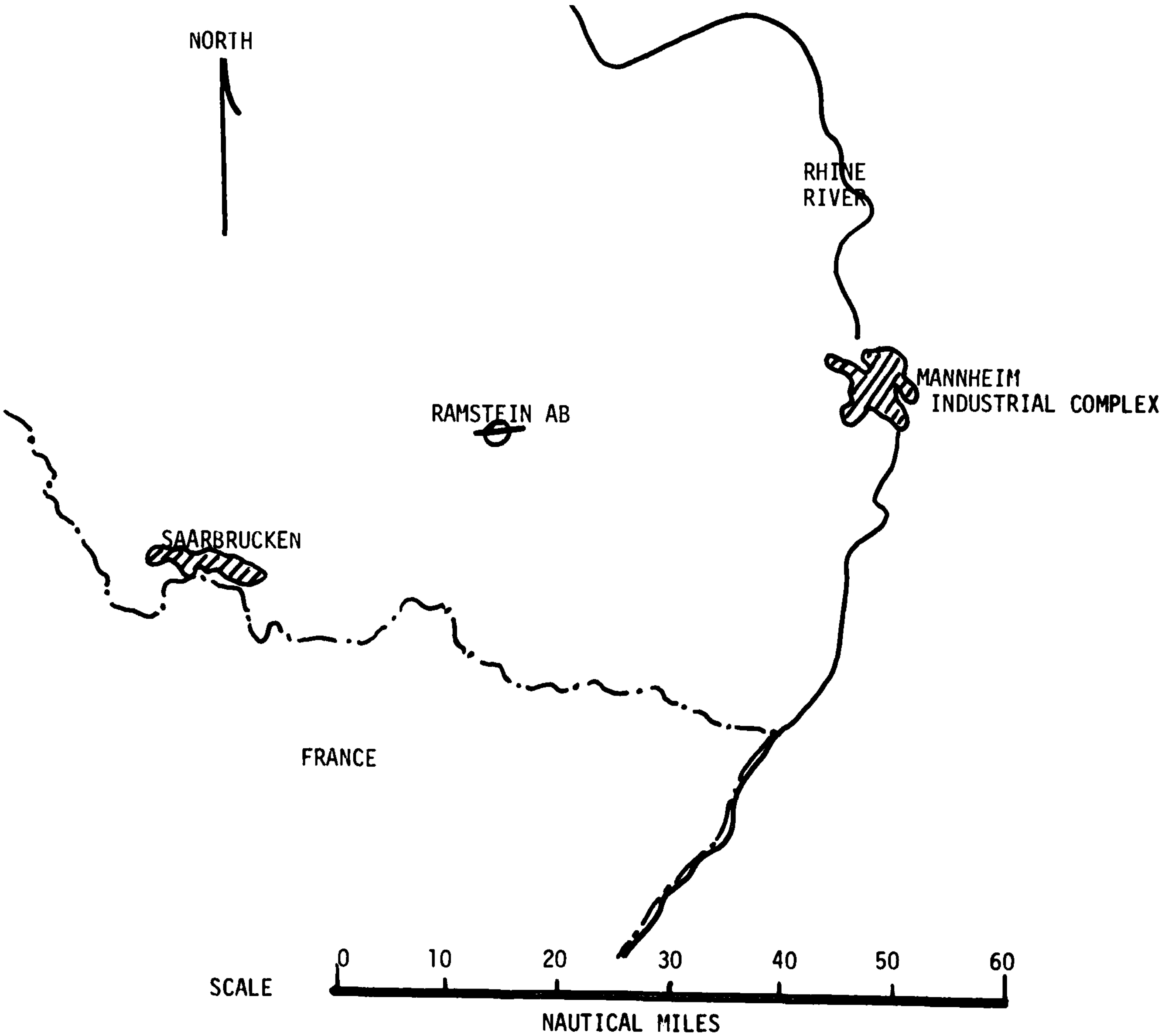


FIGURE 1-4 POLLUTION SOURCES

1-5. Terrain is a powerful influence on climate and in Europe weather may vary radically within very short distances because of altitudes and variations in land forms. Situated on the relatively level floor of a small valley sloping upward from Saarbrucken (600ft and 25NM SW) to Kaiserslautern (800ft. and 7NM ENE) Ramstein AB is afforded some protection from the upslope effects that plague the Eifel and Huhnsruck area to the North. There are still local tertiary circulations and phenomena which at times create some interesting forecast situations.

1-6. Forecasting severe weather is normally not a problem at Ramstein. The majority of thunderstorms experienced occur as should be expected between 1500 to midnight local standard time. Thunderstorms occuring outside this time frame are most often associated with frontal activity. The terminal will normally not experience the maximum gusts possible in any thundershower unless the storms movement closely parallel the floor of the valley. The occurence of high winds are rare but not unrecorded. Tight gradients and low level jets create a problem to operations at this location. Surface winds will often channel up the valley from the SW while just above the hilltops winds will abruptly shift to the west creating a wind shear and turbulence for aircraft on approach and departure.

1-7. The closest large body moisture source is the North sea 200NM to the north. Under certain conditions a persistant NW or N flow will advect moisture into the flat northern plains area and sometimes further south into the Eifel and Ramstein area. Higher elevations generally experience lower ceilings but barring any other weather phenomena flying conditions are good with the stratocumulus ceilings dissipatting at night.

1-8. Weather rarely approaches the station from the southeast as the Alps form a natural block to weather producing systems migrating north. There are cases however, when weather actually does circumvent the mountains usually in winter creating some of the most spectacular snowfalls ever recorded in Germany. This and other specific weather patterns will be discussed in chapter 4 of the TFRN. It is clear however that the specific location and topography of Ramstein AB will exert an influence on each synoptic regime and must be considered in evaluating and forecasting the elements at this location.

1-9. Instruments (Fig. 1-5)

a. Temperature:

(1) AN/TMQ 11 , a continuous duty cycle, forced air devices which automatically senses and indicates representative airfield free-air temperature and dew point. Sensor located at approximately runway center and 650' to the north.

(2) Should not be adversely affected by immediate environmental conditions.

(3) Indicators are normally representative.

(4) Requires extended period of readjustment (setting in) after power interuption.

b. Wind:

(1) AN/GMQ-20, a continuous sampling fixed device which uses a synchro system for direction and a tachometer magneto voltmeter system for speed data. A permanet recording capability is also provided.

(2) There are two sensors. Each is located at opposite ends of the runway, approximately 800' from the runway end and approximately 650' to the north.

(3) A microwave reflector and a programmed visibility instrument tower located near the sensor on runway 27 may have a slight effect on speed and direction.

(4) It is possibie to get significantly different indication from opposite ends of the runway.

c. Visibility:

(1) AN/GMQ-10 provides a continuous record and instantaneous indication of the atmospheric transmission of light between two fixed points. This is accomplished with a sealed beam high intensity lamp focused on a tube containing a light sensitive photoelectric vacuum tube. Quality of visibility markers are good.

(2) Approximately 90' of the horizon from NW-NE blocked by trees. Average visibility in this direction from 05 - 2NM.

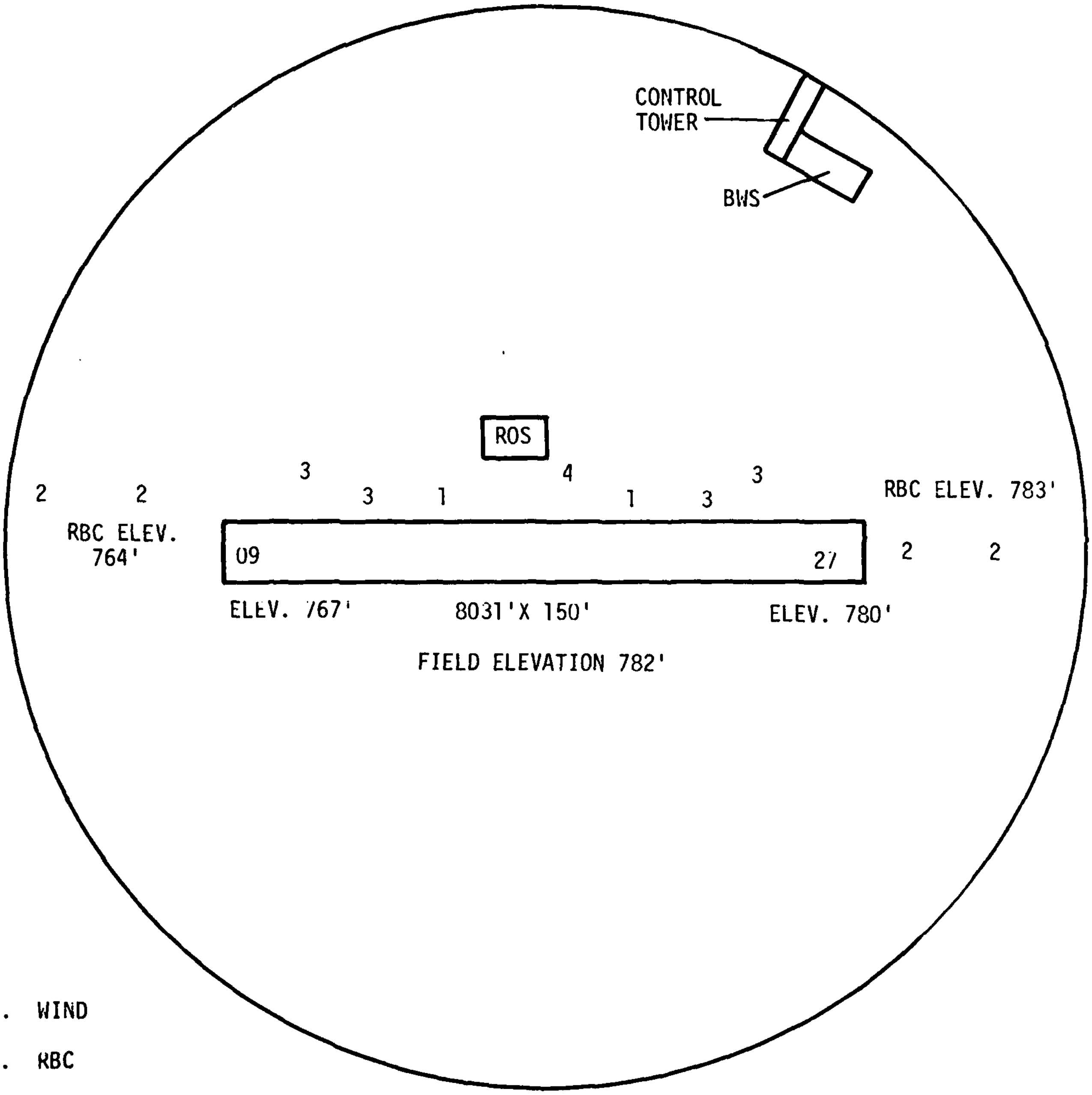
(3) Hill line from SE-SW has average visibility from 2.5 - 5 0NM. Ends of hill line are 5.0 and middle is 2.5NM. Town of Kindsbach to south is 1.2NM. MAC ramp to the west is 0.7NM. Water tower to south is 2.6NM. Hill lines behind water tower are 5.0 and 10.0NM. Large hill on horizon to WSW is 13.0NM. Ends of both runways are 0.7NM. Television tower to the SE is 3.8NM. Control tower to north is 0.16NM.

(4) Indicators may differ significantly between opposite ends of the runway.

d. Cloud Height:

(1) AN/GMQ-13, a rotating-beam type ceilometer which provides frequent and accurate observation of the height of the lowest layer of clouds. Provides both day and night observation of cloud bases.

(2) There are two sensing units. Each is located at opposite ends of the runway approximately 1500 - 2000' of the runways end. Each is slightly north of the runway certerline.



1. WIND
2. RBC
3. VSBY (RVR 400)
4. TMQ-11

FIGURE 1-5 RUNWAY INSTRUMENTS

CHAPTER 2

CLIMATIC AIDS

CRITICAL WEATHER ELEMENT	THRESHOLD	IMPACT
Crosswind	25 KT	Cancel F-4, C-145, VC-135 Operations
	27 KT	Cancel C5 Operations
	30 KT	Cancel CT-39, C-130, C-12 CT 140
	35 KT	Cancel UH-1 hover
Gust Spreads	15 KT	Cancel Army UH-1 Operations
Turbulence	Moderate	Divert CT-39, F-4, VC-135
	Severe or Greater	Divert C-5, C-141, VC-140 U-21, C-12, UH-1
Lightning	Within 5NM	Cancel refueling operations Computer and comm equipment on back up power
Icing	Trace	Cancel UH-1
	Light	Cancel CH-53, UH-1 if ceiling 010 and tops 200
	Moderate	Cancel CT-39, C-141, F-4 VC-135
	Severe	Cancel C-5, VC-140, C-12, U-21
Ceiling/Visibility	3000/4.3NM	Alternate required
	2000/4.3NM	Army VFR (full profile) FCF/USAFE VFR Min.
	1500/3.0NM	Limited FCF min
	1000/2.0NM	EDAR no longer acceptable alternate
	800/2.0NM	Cancel category III pilots
	700/1.0NM	Dual alternate min
	500/1.5NM	Cancel category II pilots
	500/1.0NM	UH-1/CH-53 VFR min
	300/1.0	Cancel F-4 Operations

CRITICAL WEATHER ELEMENT	THRESHOLD	IMPACT
Ceiling/Visibility	100/0.2	IFR minimums
Winds	30 KT	Cancel Army UH-1 Operations
	35 KT	Affects communication antennas security sensors, Civil Enginnering Army Air Defense antennas, hanger aircraft
	45 KT	Cancel UH-1 Operations
Snow/Freezing Precip	Any amount	Affects barrier maintenance Civil Enginnering, Roads and Grounds, Security Police, Bahn B, schools and clinic

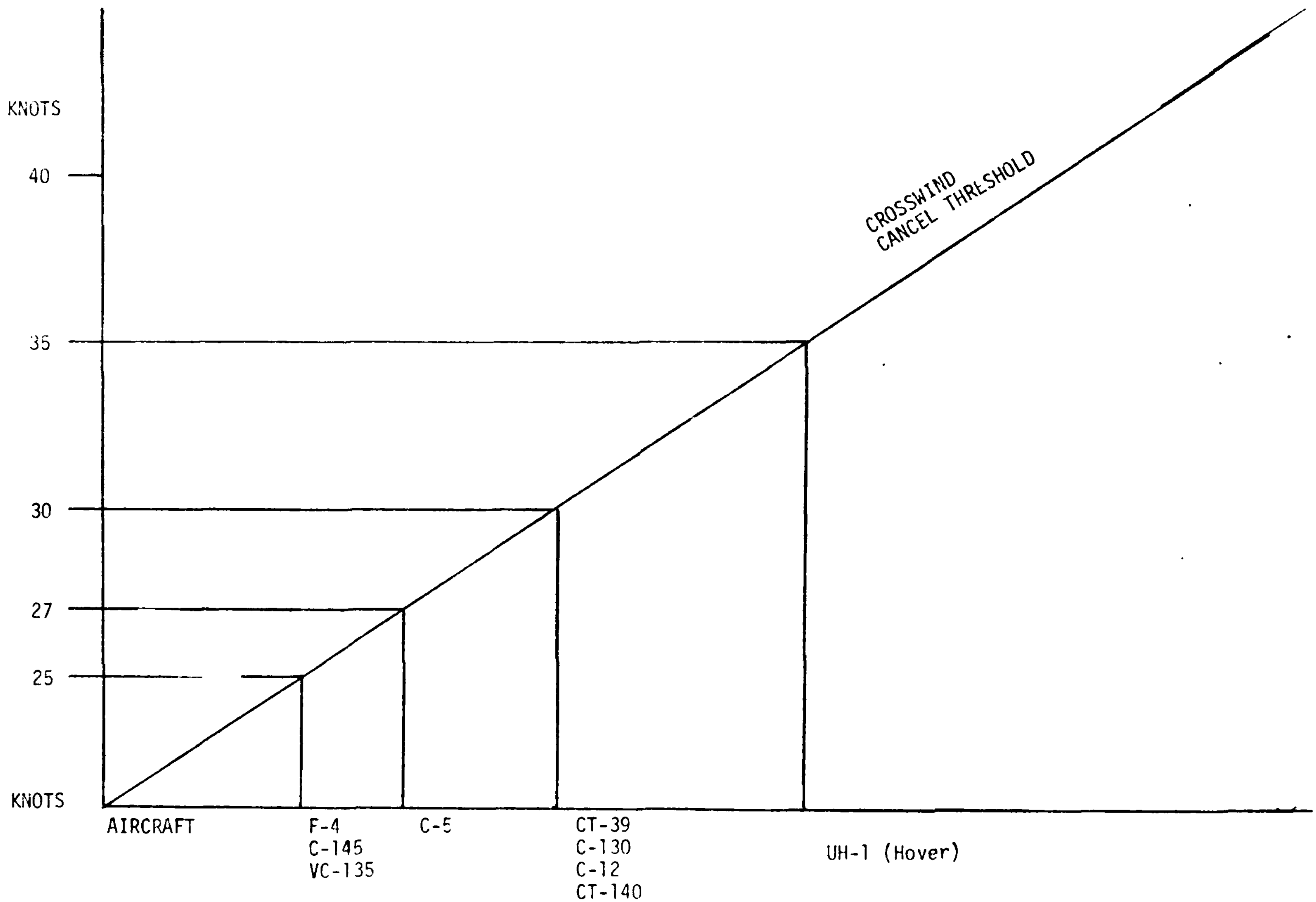


FIGURE 2-3 CROSS WIND THRESHOLD

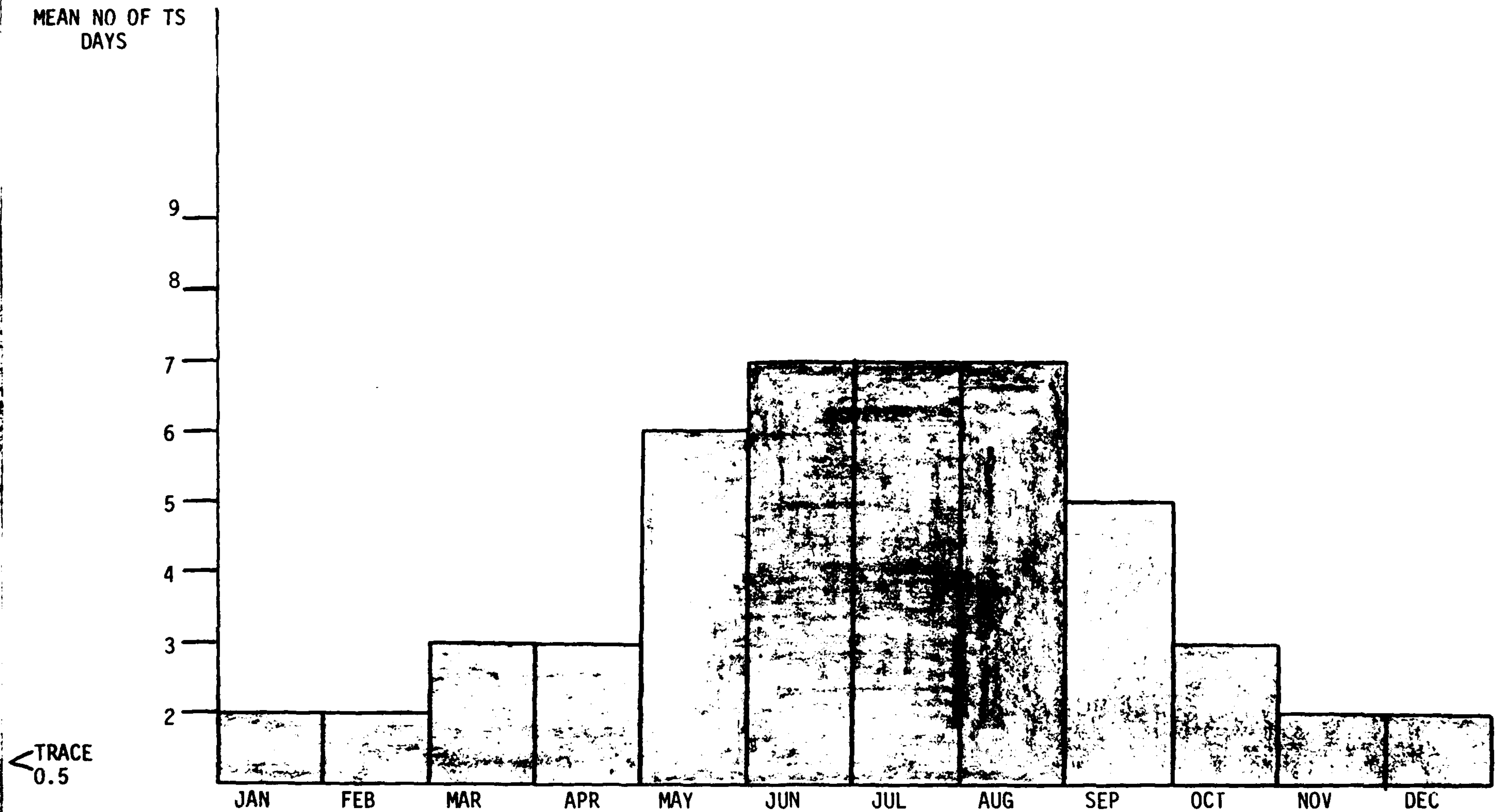


FIGURE 2-4 THUNDERSTORM DAYS

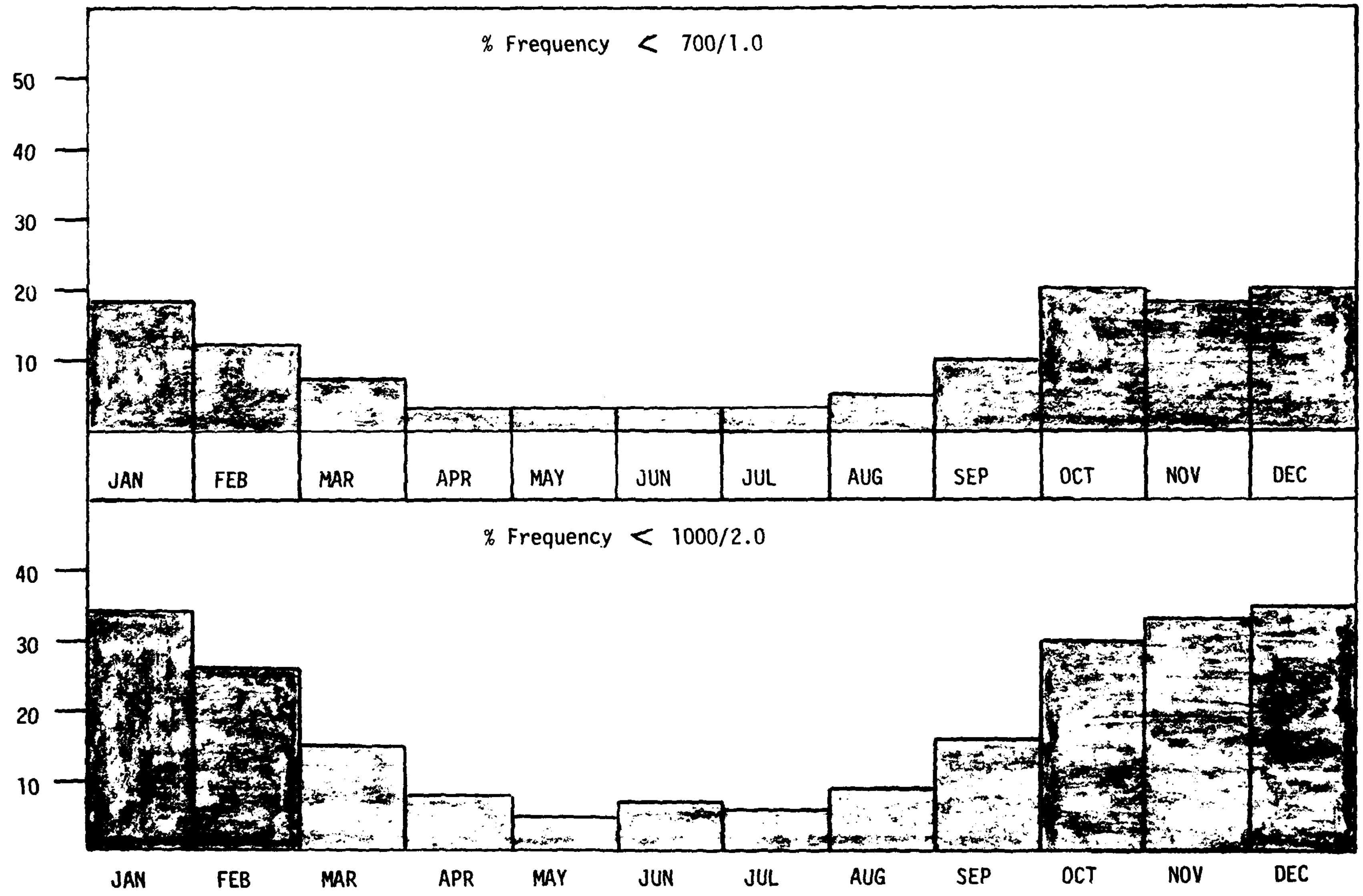


FIGURE 2-5 CEILING/VISIBILITY

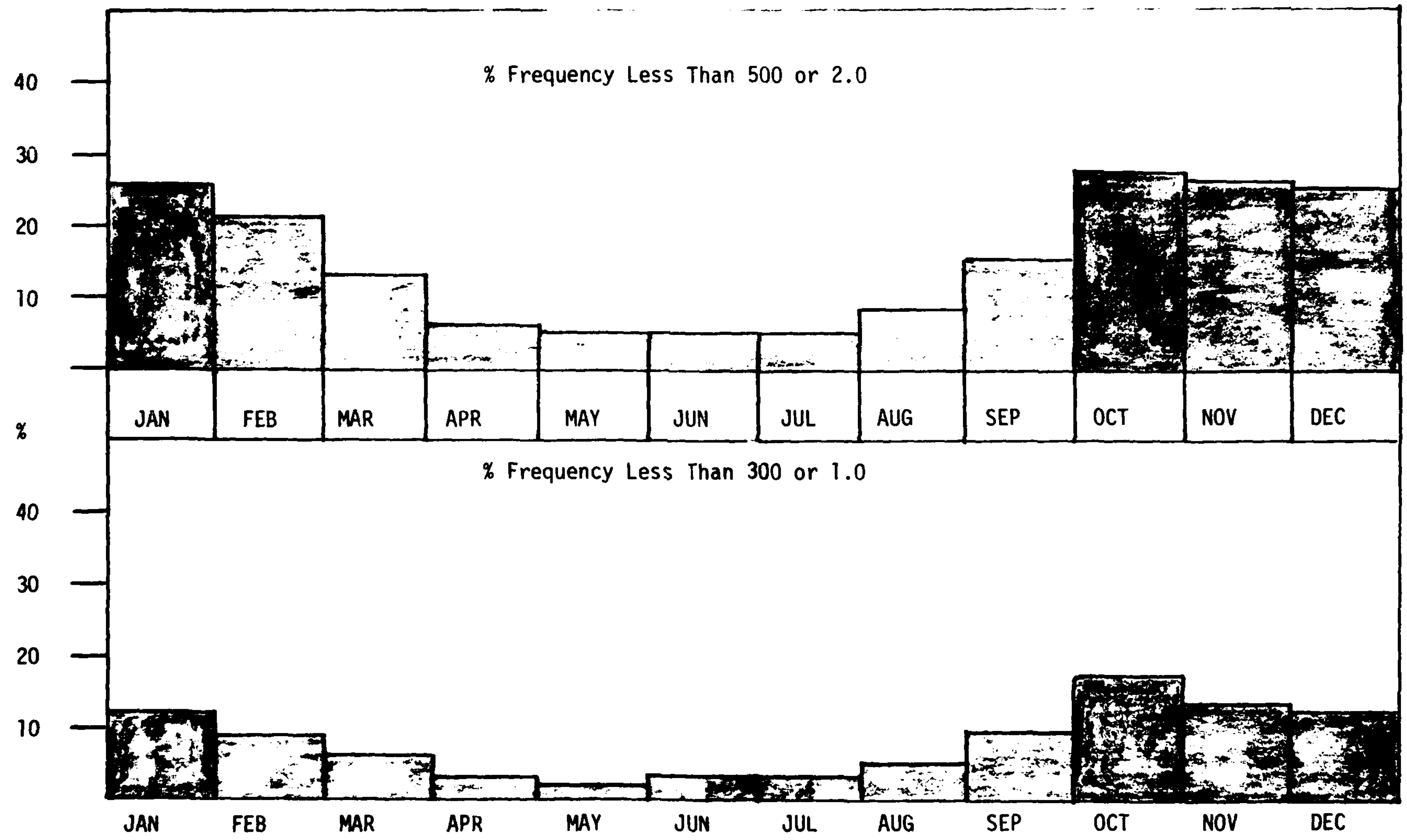


FIGURE 2-6 CEILING/VISIBILITY

CHAPTER 3

LOCAL FORECAST STUDIES

There are no approved local forecast studies at Ramstein AB, Germany.

CHAPTER 4

WEATHER CONTROLS

4-1. Climatology; is perhaps the best substitute for experience. An awareness of large scale climatic features and seasonal changes is the key to understanding climate and its variations from place to place. Prevailing weather patterns in the Ramstein forecasting area are not unlike other stations in the North Temperate Zone, but the climatic controls at work in this region do create differences that are significant to both land and air operations.

4-2. Ramstein has a somewhat modified maritime climate. Throughout most of the year the predominant air mass over the region is maritime polar (mP). Most often modified by a long trajectory over the North Atlantic and the warm waters of the North Atlantic drift, (Fig. 4-1) winter temperatures are at least ten degrees warmer over western Europe than comparable latitudes in North America. This tends to give Europe mild winters and pleasant summers.

The predominant airflow into Germany during all seasons is over the Atlantic, and the lack of any major terrain barriers in northern or central Germany allows the influence of the ocean to penetrate most areas. As a result, the high moisture content of the air produces a high frequency of cloudiness and frequent precipitation generally increasing from north to south.

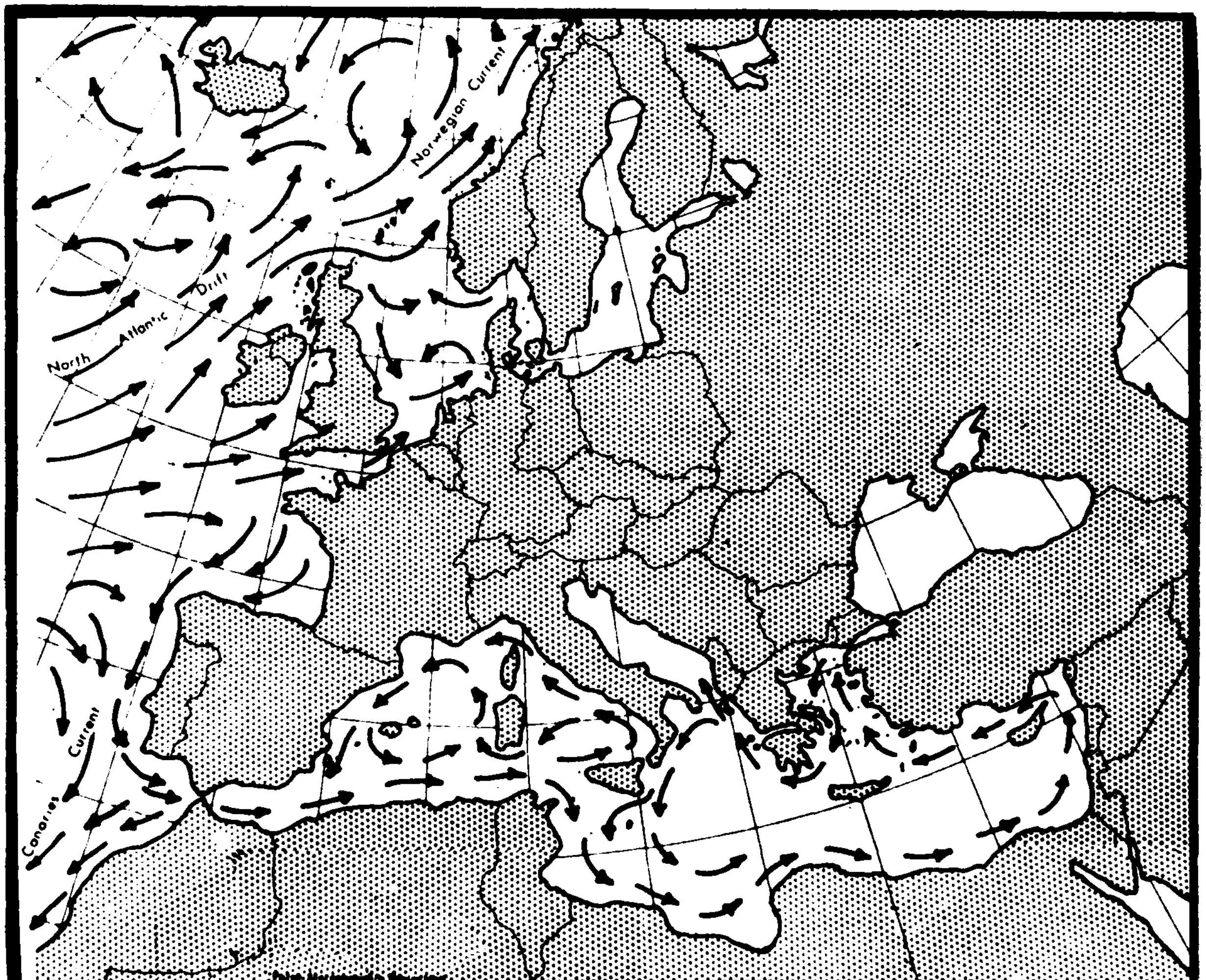


FIGURE 4-1 OCEAN CURRENTS AFFECTING EUROPE

4-3. Controlling the main circulation over this region are three great pressure systems: the Icelandic low, the Azores high, and the alternating winter high and summer low of central Asia (Fig. 4-2). The interaction and seasonal strengths of these semi-permanent features is one of the climatic keys to forecasting weather in the European theater.

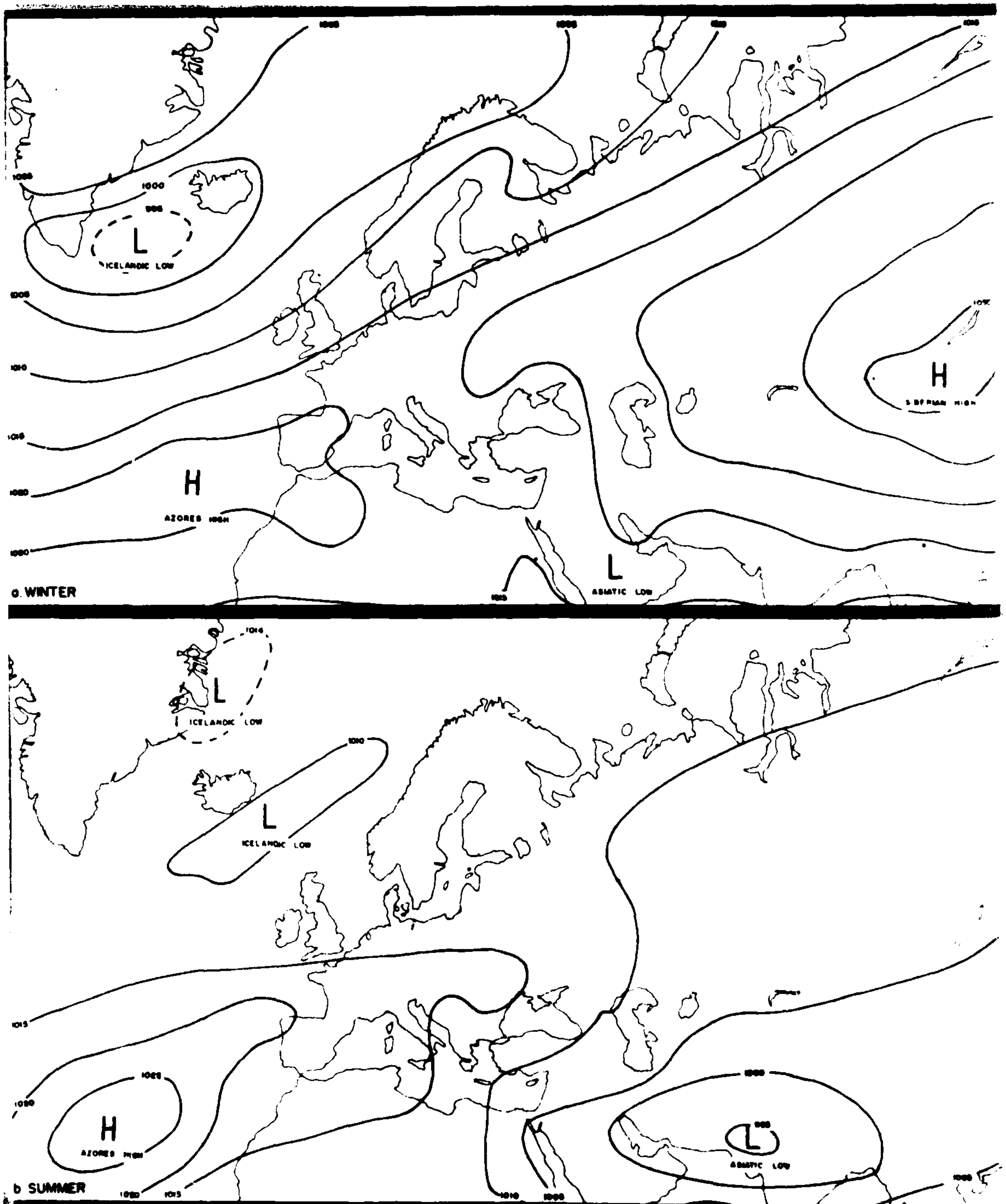


FIGURE 4-2 MEAN WINTER AND SUMMER POSITIONS OF THE MAJOR SEMI-PERMANENT SYNOPTIC FEATURES

4-4. Winter (Dec, Jan, Feb)

a. The comparative mildness of European winters and Germany in particular, is a reflection of the mean and caution should be used so as not to understimate the potential for hazardous weather phenomena. Winters at Ramstein pose the most difficult forecast situations of any season. Winter is the season of low clouds, fog, frequent precipitation and generally below freezing nighttime temperatures.

b. The Azores high decreases in intensity and moves to the south while at the same time, the Icelandic low intensifies and provides a strong westerly or southwesterly flow and path of low pressure across the North Atlantic. Cyclone families in the Icelandic low move ESE across Scotland into the North Sea and tend to move directly across the North Sea into southern Scandinavia. These migrating storms are the primary cause of most of the winter precipitation.

c. The continental land mass is usually cold, and in winter often snow covered. The surrounding seas are warmer than the continent and a cold front or a depression from the west usually brings extensive cloudiness and moderate temperatures. In fact, surface temperatures are often warmer behind the cold front posing a difficult analysis problem to new forecasters not familiar with the weather of Europe.

d. Between passages of these migrating lows, relatively short duration highs from the Atlantic pass over the region accompanied by westerly to northwesterly winds. Usually associated with these highs are good visibilities, scattered to broken cloud cover and some shower activity.

e. When blocking occurs by either the Azores or Siberian anticyclones disturbances moving out of the Icelandic low will stop in the North Sea or drift slowly E-ENE following the primary storm track along the northern border of the continent. Generally a 48-72 hour period goes by with little or no improvement and an actual frontal passage, if it does occur, will often not be sharp as the front will drag past the station placing Ramstein in the actual frontal zone for as long as 18 hours. Frequently, after frontal passage minor short waves or a secondary trough will move through the pattern causing snow showers or periods of mixed rain and snow at intervals of 7 to 12 hours (Fig. 4-3). The intensity of these disturbances will usually decrease with time and tend to shift further north as the associated surface cyclone curves north over the top of the blocking ridge.

f. In winter the Siberian anticyclone will generally form a more persistant block than the already seasonally weakened Azores High and may often preclude frontal weather in the Ramstein area altogether (Fig. 4-4). It is during mid-winter that the cold Siberian High reaches its maximum intensity and often extends its influence into western Europe. An extension of the Siberian High will usually brings winds, which are often gusty, from the east, intensly cold temperatures and either clear or very cloudy weather depending on the vertical depth of the cold air. The first 24-48 hours of an influx of this Russian anticyclone may bring extensive sheets of stratus causing low ceilings and poor visibilities. As the center of the high moves closer to the station clouds decrease and fog becomes less intense as the drier continental air invades western Europe. Visibilities are often poor during the early morning hours becoming 3-5 miles in haze during the afternoon.

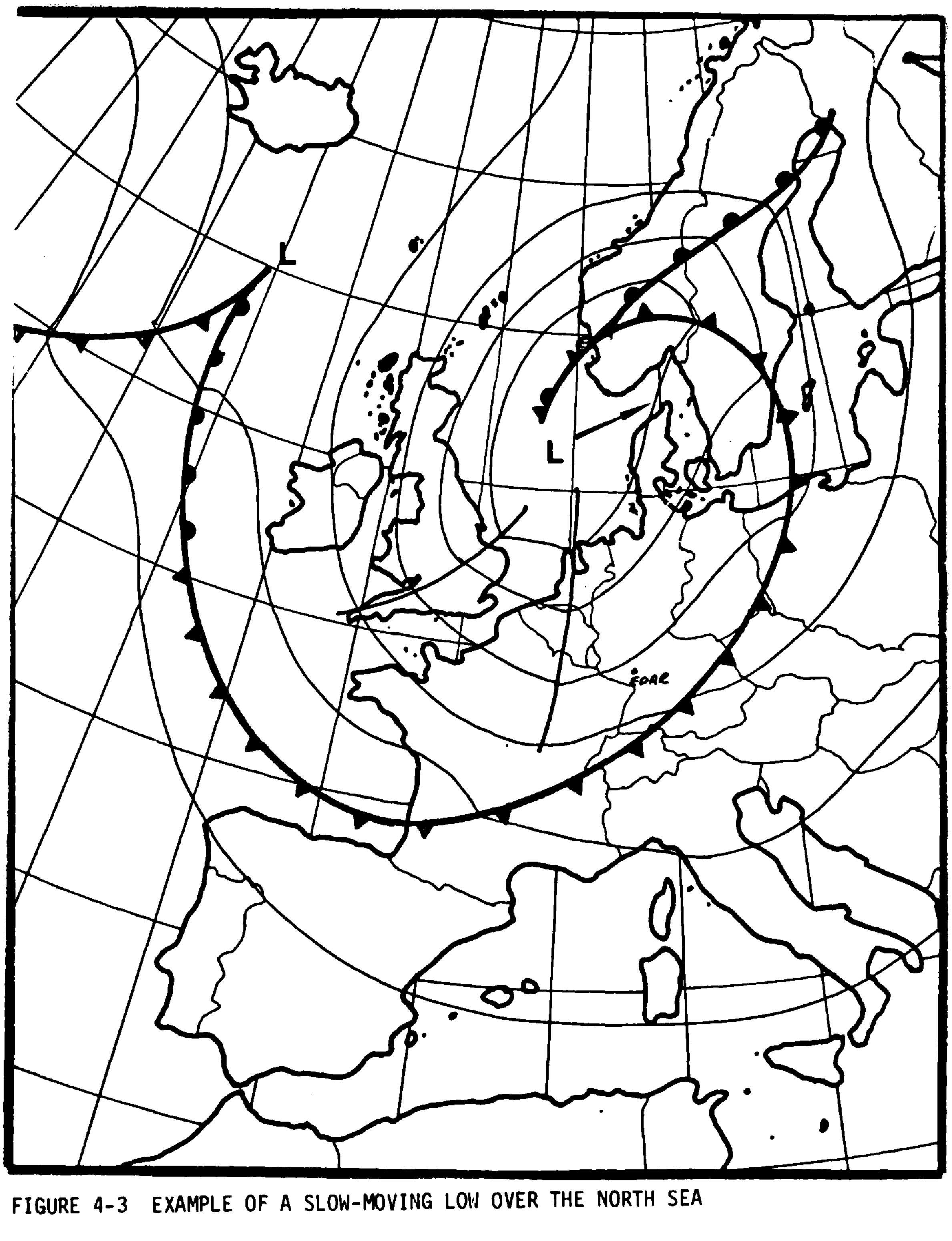


FIGURE 4-3 EXAMPLE OF A SLOW-MOVING LOW OVER THE NORTH SEA

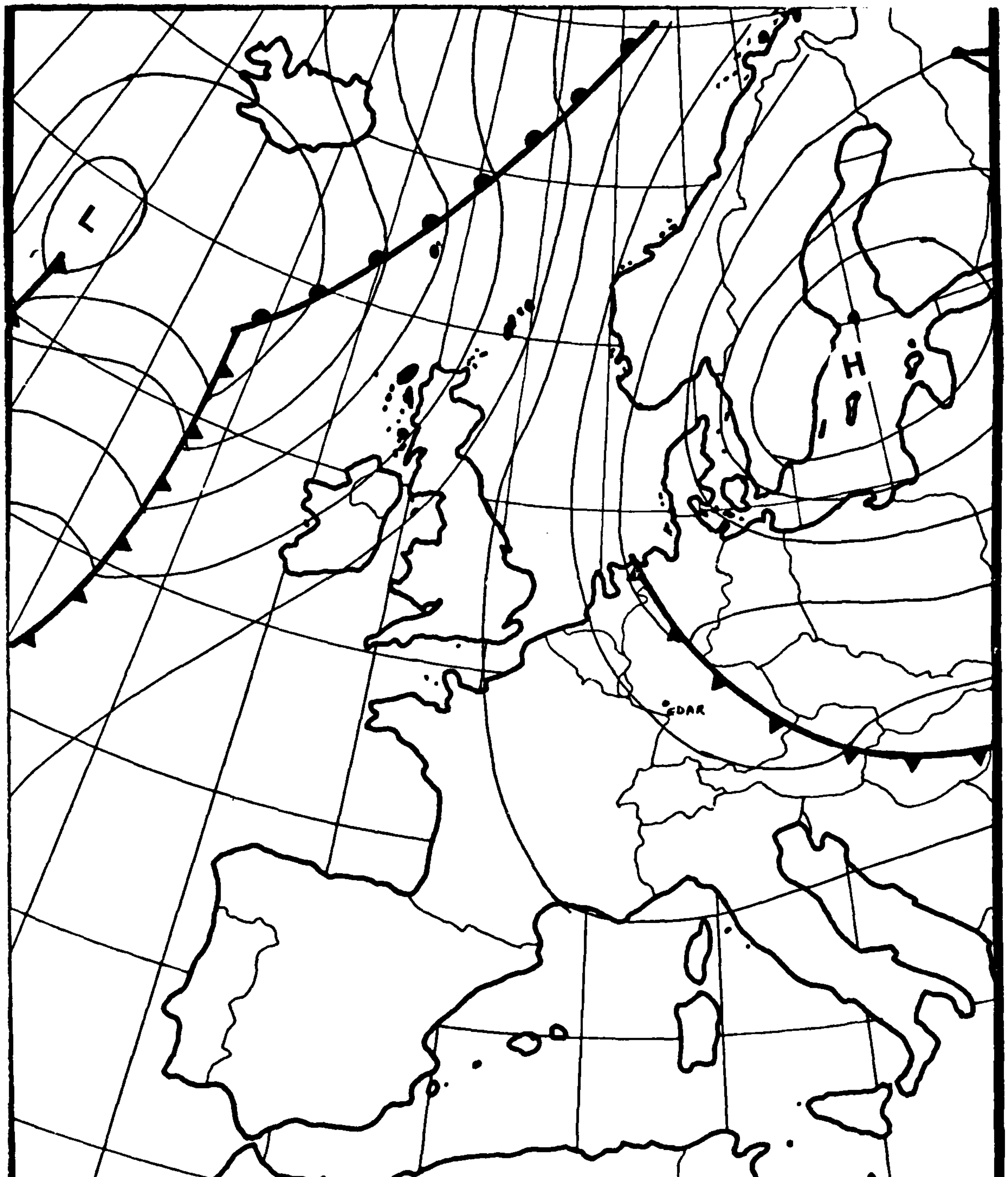


FIGURE 4-4 EXAMPLE OF A STATIONARY SIBERIAN HIGH

g. Most European cyclones move in a generally zonal direction along one of three preferred paths. These are primary tracks along the northern and southern borders of the continent and a third track of lesser frequency across the North and Baltic Seas. A few storms enter the southern tracks near the English channel or Brest Peninsula (Fig. 4-5a) and are often quite significant to the Ramstein forecasting area. The sparsity of data beyond the Brest Peninsula and Lands End makes it difficult to assess exactly what kind of support these systems have in order to determine the future movement and intensity of the storm. These depressions tend to move along two preferred paths, either continuing southward into the southern track and into the Mediterranean or into the English channel along the northern French border usually entering the continent close to the Belgian-French border. Although this type of cyclone will appear in all seasons, during the winter the potential for adverse weather is at its greatest. Extensive overrunning will often reach the Ramstein area well in advance of the storm itself, Fig. 4-5b) greatly increasing the chances of freezing precipitation and severe icing conditions as well as low ceilings and poor visibilities. Several hours of freezing rain or drizzle may occur before the warmer air in the SW quadrant of the low arrives to change the character of precipitation into rain or rain and snow. The typical pattern is freezing rain or drizzle turning to mixed snow and rain until the low passes to the northeast and a return of the cold air from the northwesterly flow around the low turns it into snow. (determining the exact track of the depression is the key to forecasting this situation and it is wise to follow the isollobaric pressure falls on the surface chart as well as any fluctuation in the maximum wind band). A situation peculiar to Europe is the overrunning of warm moist air from a deep stationary low in the Mediterranean. When a closed low in Ligurian Sea stagnates up to 300MB's it remains stationary for several days. It usually begins to move across northern Italy into the Gulf of Venecia and continues across northern Yugoslavia, Austria and may come into souther Germany and even as far north as Ramstein. During this voyage the moisture is constantly transported northward on the eastern side of the low and warms fronts or troughs are created. These trough move northwestward extending a continuous rain or snow pattern from southern Germany as far north as Frankfurt-Spangdahlem area. The ridge over northern Europe increases the generally easterly flow over central Germany and moves the trough at speeds from 5-15 kts. A period of 24 to 48 hours elapses before the low ceilings (1-2000ft) and rain or snow reaches the Ramstein area. Over Ramstein lows normally recurve, fill and move northeastward. During the winter such situations produce the greatestsnowfalls in Germany (Fig. 4-6).

h. Winter migratory anticyclones are primarily of two types; those which originate in middle latitudes and move mainly eastward, and those which originate at high latitudes and that are extensions or segments of the Azores high. They usually give fine bright weather with very good visibility, although fog and mist will generally form in the early morning. Anticyclones moving southeastward out of the Iceland Greenland area tend to stagnate in southern or eastern Germany for a few days before breaking down. During these periods there is widespread fog (Fig. 4-7

i. Forecasting European weather can be a most rewarding or frustating experience and at the very least provide an unparalleled opportunity for the meteorologist to polish, practice and develop his or her skills to a high degree.

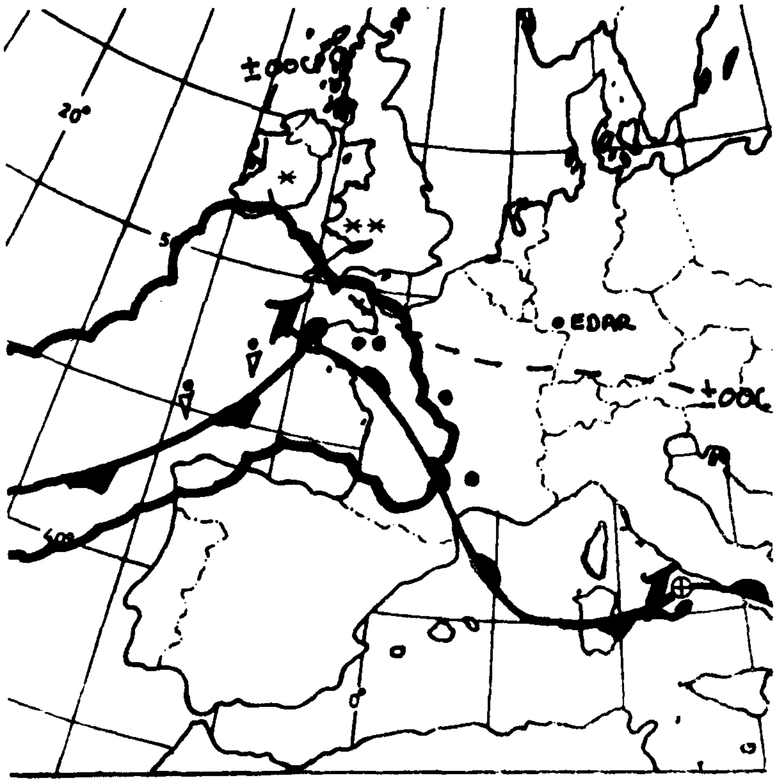


FIGURE 4-5A

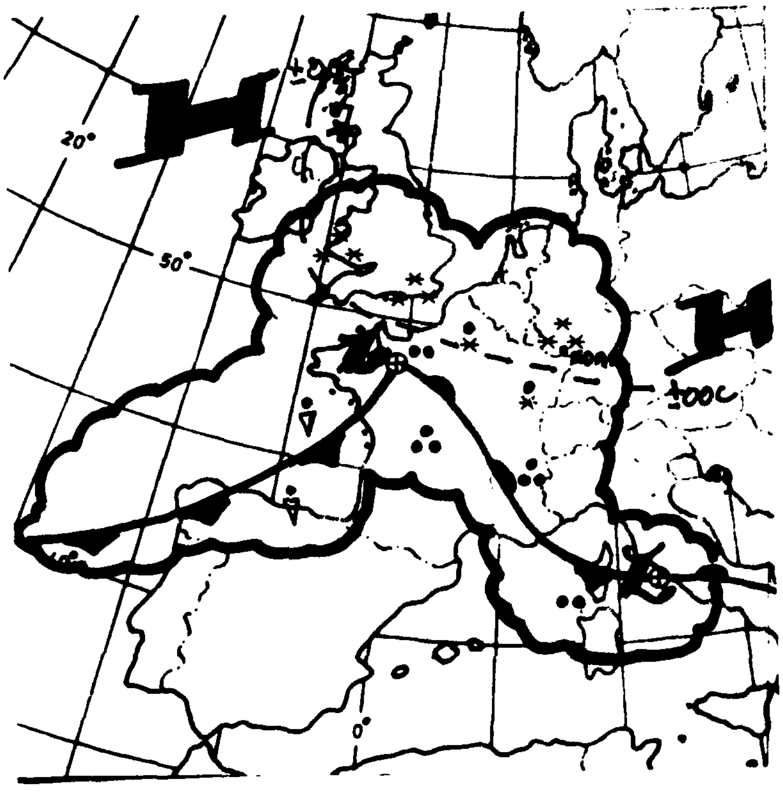


FIGURE 4-5B EXAMPLE OF LOW ENTERING SOUTHERN TRACKS

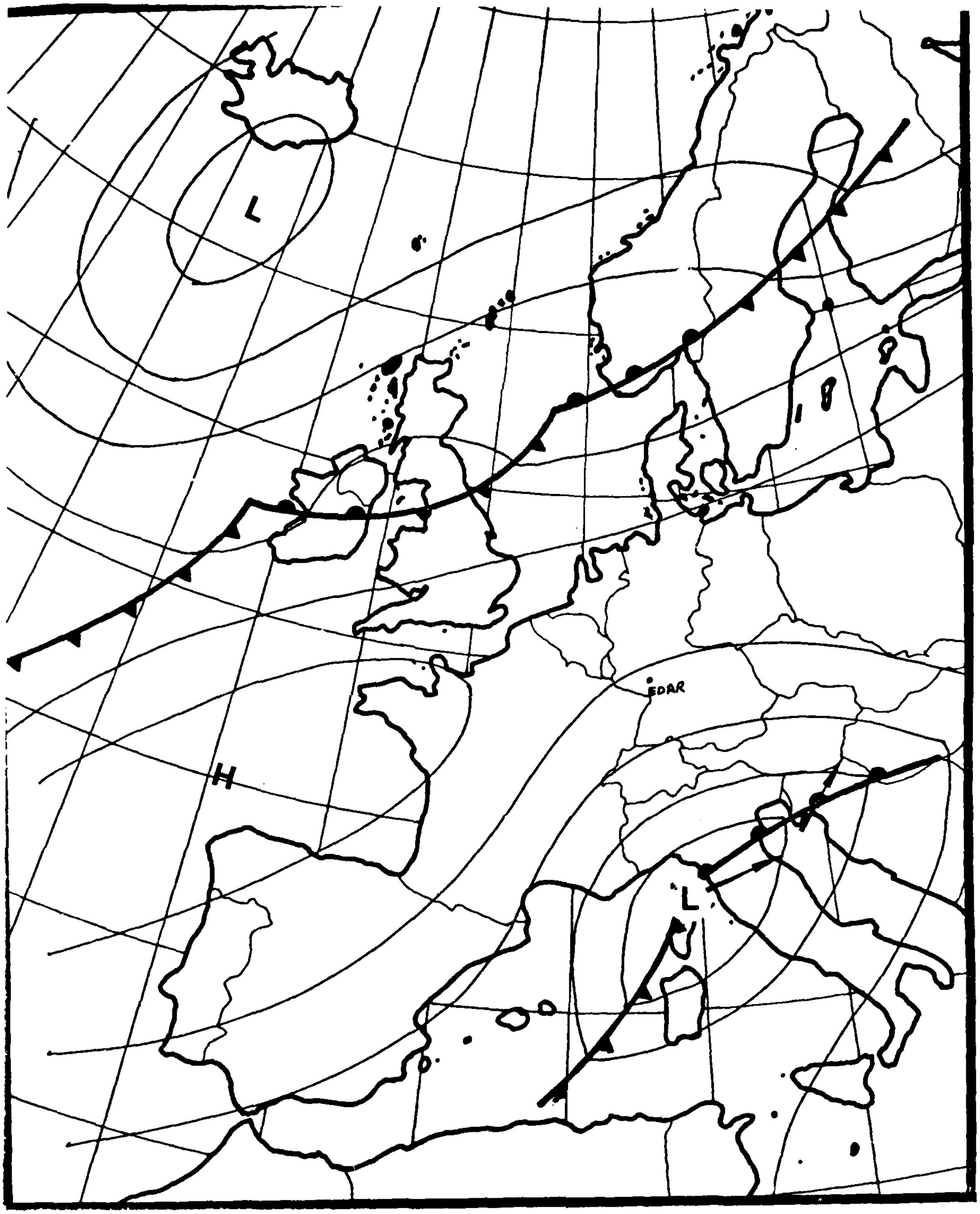


FIGURE 4-6 EXAMPLE OF A DEEP LOW IN THE LIGURIAN SEA

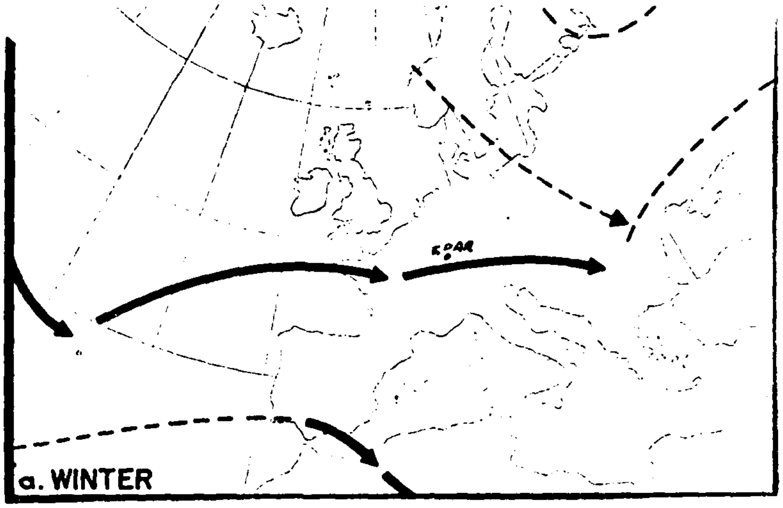


FIGURE 4-7 MEAN PATHS OF ANTICYCLONES

4-5. Spring (Mar, Apr, May)

a. The transition seasons are often difficult periods to forecast for newcomers as well as the old hand on station. At times, the mixture of seasonal characteristics is so tangled it is near impossible to tell what regime will have the controlling influence. The transition from winter to spring is a prime example as March and April are normally stormy months with many winter-like intrusions.

b. During spring, the Icelandic low begins to decrease in intensity while the Azores high develops and pushes into Europe (Fig. 4-8). Circulation over the area is variable, but there is more of a tendancy for northwesterly flow than in winter. The apparent storminess of early spring is in part due to the shifting influence of the Azores high and the still active Icelandic low. As mean daily highs climb from 40°F in February to 49°F in March and 57°F in April, the contrast between cold outbreaks associated with the Icelandic low and the warming continent can create strong frontal discontinuities.

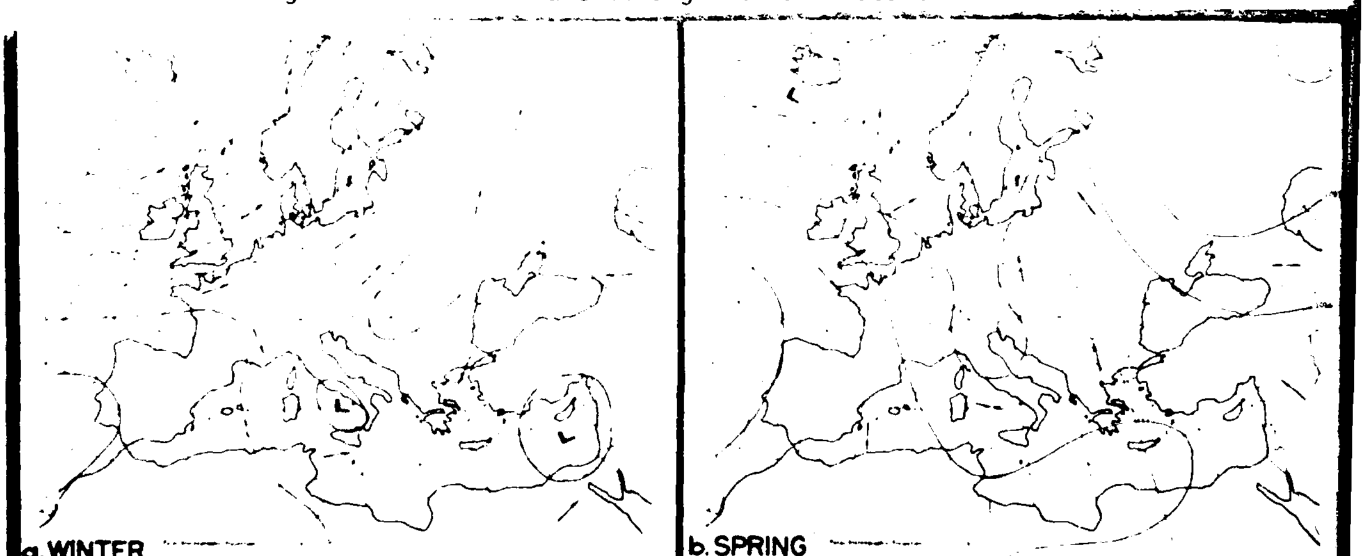


FIGURE 4-8 COMPARISON OF MEAN SEA LEVEL PRESSURE, CIRCULATION AND WINDFLOW

c. Blocking activity over the Atlantic is most frequent during spring and increasing insolation results in more rapid heating of land than surrounding water surfaces (Fig. 4-9). As a result existing centers of cyclone frequency are displaced landward. New centers of cyclone frequency appear inland over central Europe and southern Scandinavia. This is also a factor in the frequent storminess of this transition season as the principal storm tracks which had been over water are dispaced to land areas.

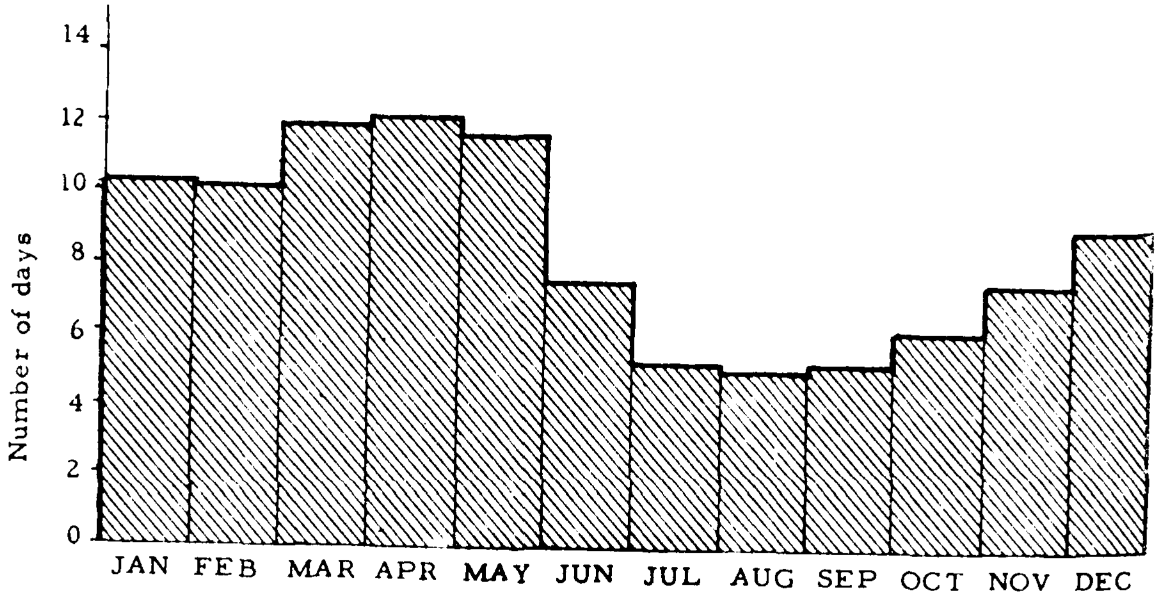


FIGURE 4-9 BLOCKING DAYS

d. The poleward shift of the principal anticyclone tracks also commences in March and April becoming more extensive by May (Fig. 4-10). Frequently, after a frontal passage anticyclones moving in behind the system will set up the classic fog producer of rainy days followed by rapid clearing and radiation fog.

e. Thunderstorm activity commences in April or early May as the predominant flow shifts to the northwest bringing moist conditionally unstable air from the North Atlantic over the relatively warm land. By the end of spring thunderstorms are observed 2-5 days per month.

f. In general spring is the season of the rainshower. As the continental landmass begins warming the stratus of winter gradually gives way to cumulus and the existance of the sun is again reconfirmed.

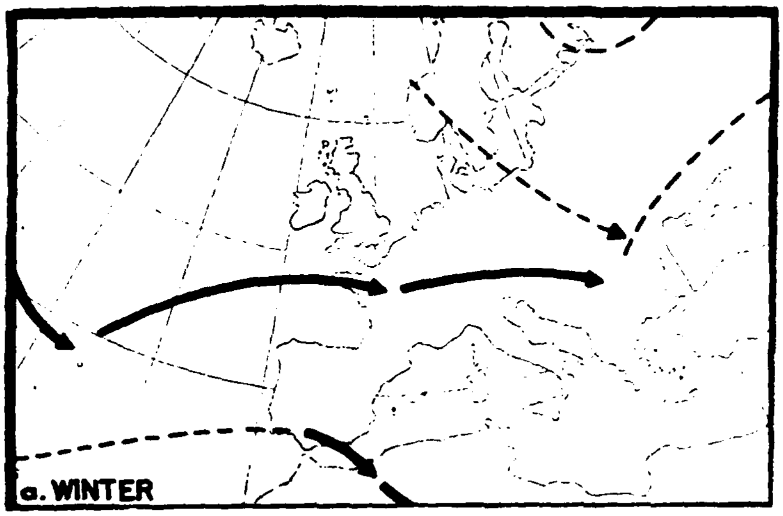


FIGURE 4-10 COMPARISON OF ANTICYCLONE PATHS

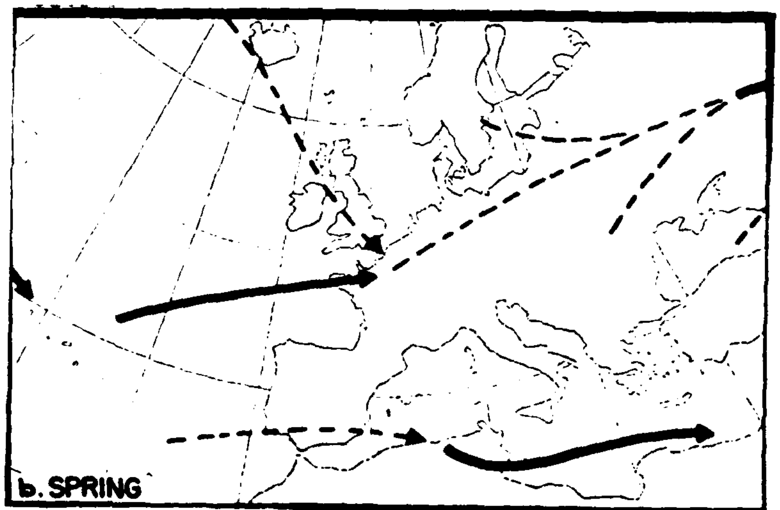


FIGURE 4-10 COMPARISON OF ANTICYCLONE PATHS

4-6. Summer (Jun, Jul, Aug)

a. Statistically, summer is by far the best of all seasons in Germany. With the exception of thundertorms, there is a marked decrease in all adverse weather phenomena resulting in some of the finest flying and Bar-B-Q weather in the world.

b. The Azores high is well developed and is the major influence during summer months. With the intensifying of the Azores high a ridge of high pressure over the area generally results in a block against migratory lows entering the continent; particularly since migratory pressure systems from the Atlantic are fairly weak in summer. The general circulation is much weaker than in winter and as summer progresses a marked northward shift of most features of the general circulation normally occurs. The primary storm track is now around 60N while middle and southern tracks have all but disappeared. The principal tracks of anticyclones, like those of cyclones is also farthest north during summer with a preferred track around 50N (Fig. 4-11).

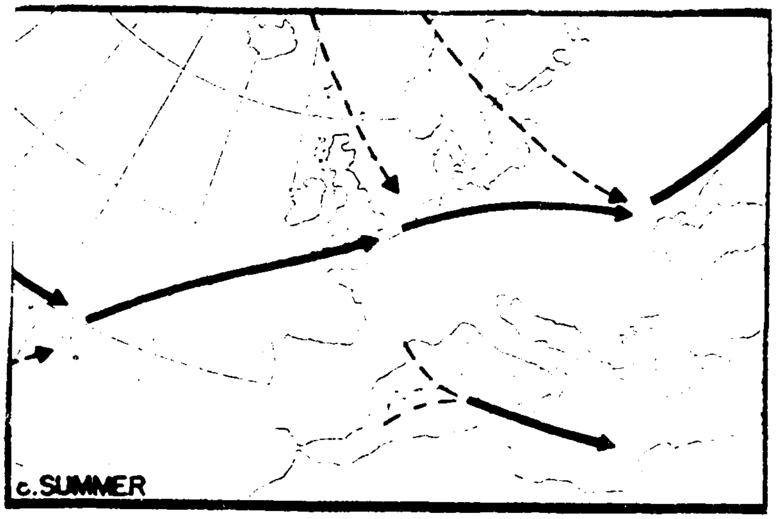


FIGURE 4-11 MEAN PATHS OF ANTICYCLONES

c. Invasions of maritime polar air produce mild weather but with diminished wind velocities, the air mass moves slowly across the land and consequently daytime heating causes a rapid modification of the source properties. While the air remains over land, heating produces an increasingly unstable air mass and cumuliform clouds are quite common.

d. Thunderstorm activity commences in late April or early May. A predominant airflow from the northwest often brings moist, conditionally unstable air from the North Atlantic over the warm land (Fig. 4-12). The lift provided by convection as well as mechanical lift provided by rough terrain, results in thunderstorm development. In Europe, and Germany in particular cloud tops do not need to attain great heights before producing a thunderstorm. Thunderstorms can and do occur with tops as low as 12 to 15 thousand feet. These thunderstorms are of relatively short duration and less violent than larger storms but still pose a definite hazard to operations. Tops of comulonimbus clouds do frequently reach above 30,000 feet and can be extremely violent with severe up-and-down drafts accompanied by gusty surface winds. Thunderstorms of the air mass type are usually isolated so that it is difficult to forecast when and where they will occur. Cold fronts or an occasional migratory low will sometimes move in from the west or northwest causing thunderstorms and rain showers, most often just ahead or close to the frontal boundry followed by clearing behind the system.

e. Dense fog is generally not a problem during the summer months. Fog days are fairly uniform throughout the year, but summer fog is usually not as dense or persistant as in other seasons. If precipitation has fallen during the day and clearing is expected during the night there is a good chance that fog will form sometime before sunrise. Sunrise visibilities of 2-3NM are not uncommon after a day of rain or rainshowers. Stratus formation is not common in summer fog situations and generally cumulus will form after the fog breaks up.

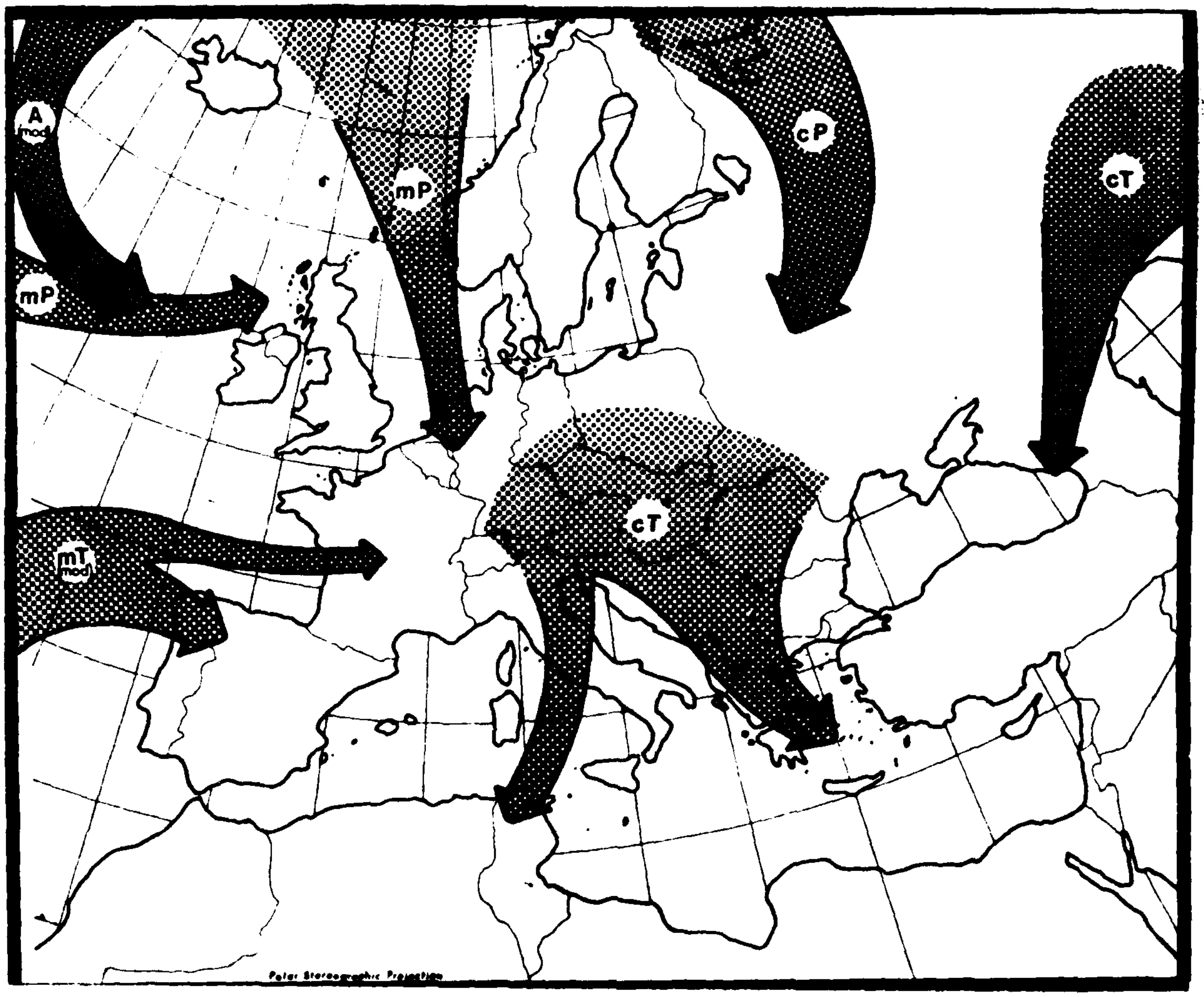


FIGURE 4-12 SUMMER AIR MASS SOURCE REGIONS, TYPE AND MOVEMENT

f. The location of fronts during summer just as in winter, is not as simple as the classic model would indicate. Summer is however the season of minimum blocking and of maximum zonal flow, so that the characteristics of frontal weather during this season are closest to those of North America.

g. The longest periods of poor flying weather occur with wave development in the vicinity of Ramstein. This wave development usually occurs on an old slow moving cold front extending from a low center far to the north. The weather associated with these new lows is a combination of upslope motion, with a southward wind ahead of the front, warm frontal upslope motion, and usually development of the pressure gradient and convergence. If the wave forms to the northwest, or north little poor weather is experienced at Ramstein. Unless the low moves south, only a cold frontal passage and shower activity occur. If the wave forms to the southwest and moves towards Ramstein while developing, precipitation, low ceilings and poor visibilities will occur and continue until the center passes away to the northeast and the cold front has passed the station.

h. Warm fronts approach Ramstein basically from two directions, either from the northwest or southwest. Warm fronts approaching from the northwest show the cloud structure expected in the classic model. High, middle and low clouds are experienced. Warm fronts approaching from the south however, offer a different type of weather. These fronts generally only cause low cloudiness with very little middle or high clouds. This is due to the fact that the air in the warm sector is usually modified MT or CT and has a low moisture content in the upper levels. A weak wave on the polar front located in the Bay of Biscay may enter western France, curve northeastward across France, pass over central Germany, and continue toward Berlin (Fig. 4-13). This synoptic situation brings precipitation into central Germany well in advance (12-18 hours) of the approaching low. Clouds may be expected as low as 1400-1700 ft MSL.

i. Very few occlusions pass this station during the summer. In summer the point of occlusion generally lies over Denmark. If an occlusion does pass in the summer, ceilings are generally high. Thunderstorms have occured several times with passage of occlusions in summer so it is wise to evaluate stability indexes as an occlusion approaches.

4-7. Autumn (Sep, Oct, Nov)

a. The transition from summer to fall is usually not very dramatic. The circulation of early autumn, like summer is still fairly weak. No overall dominant circulation pattern is indicated, but there is a tendency toward southwesterly circulation by late autumn. The circulation gradually becomes more intense as they season progresses and by mid-November. The four pressure fields of winter are identifiable on the Mean pressure map.

b. Early autumn greatly resembles late summer in many aspects of its cyclonic activity. The prevailing westerlies and associated storm tracks are still far to the north. Thunderstorms still occur an average of 2-3 days a month but decrease rapidly in frequency as the season progresses.

c. During mid autumn, the main belt of westerlies normally begins to move south so that by late October or early November several features of the storm tracks which are characteristic of winter make their appearance (Fig. 4-14).

d. The principal anticyclone tracks during early autumn closly resemble those of the summer months. A sharp fall in anticyclone frequency over previously cold water surfaces is evident as autumn progresses and the track shifts further south (Fig. 4-15).

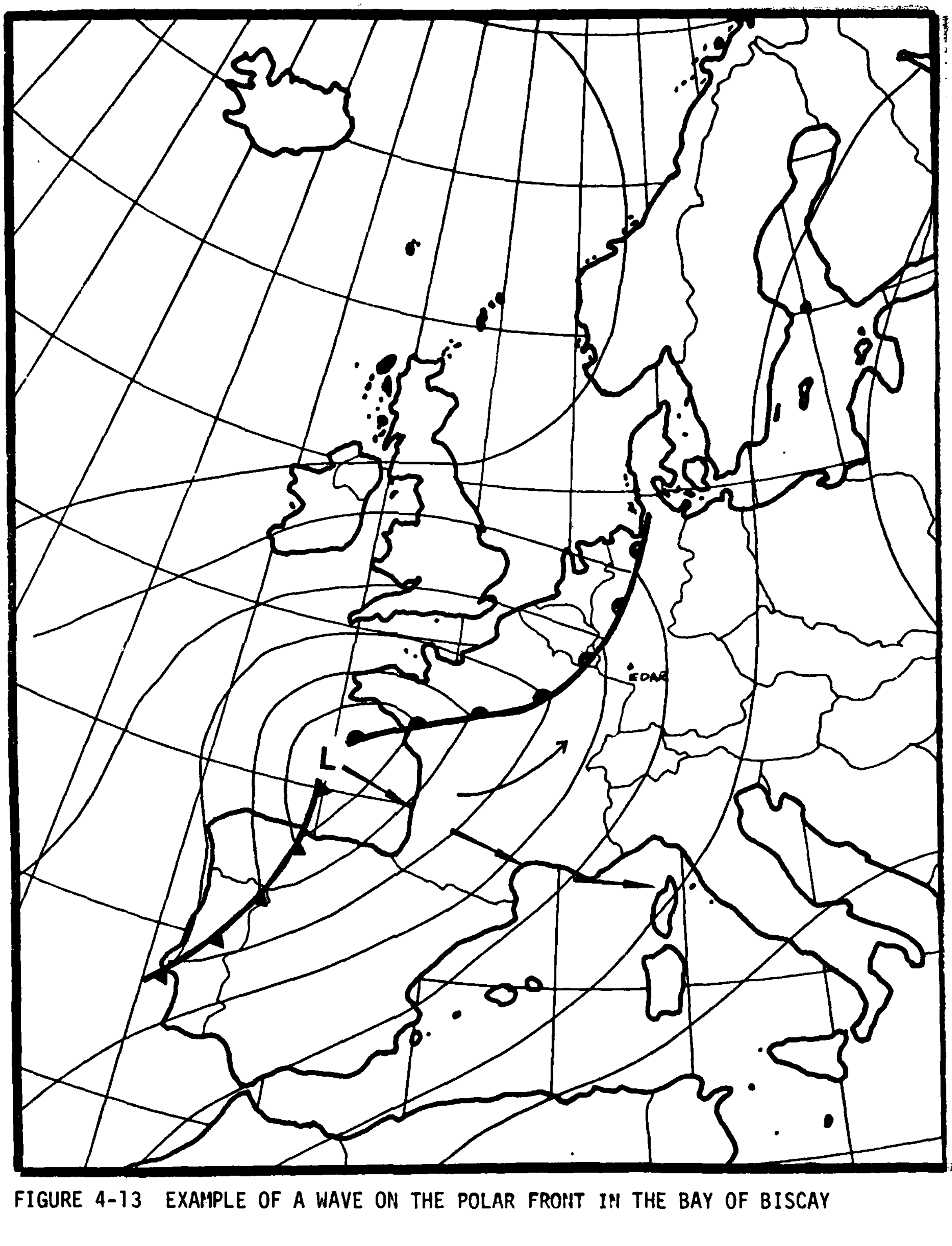


FIGURE 4-13 EXAMPLE OF A WAVE ON THE POLAR FRONT IN THE BAY OF BISCAY

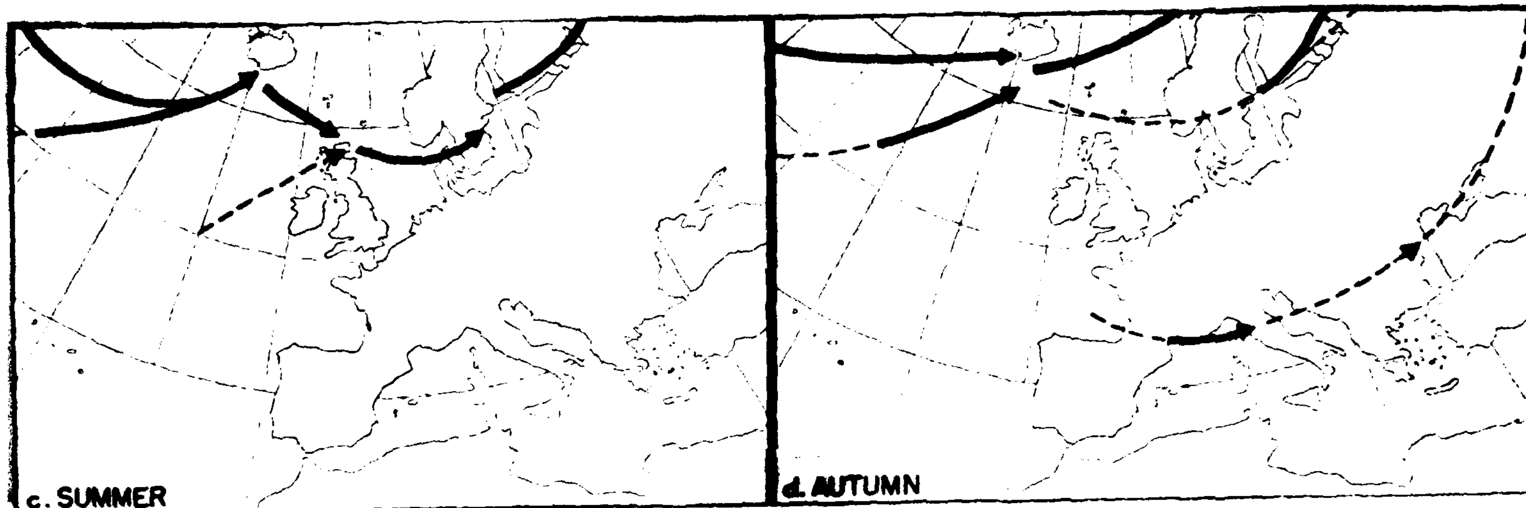


FIGURE 4-14 COMPARISON OF CYCLONE TRACKS

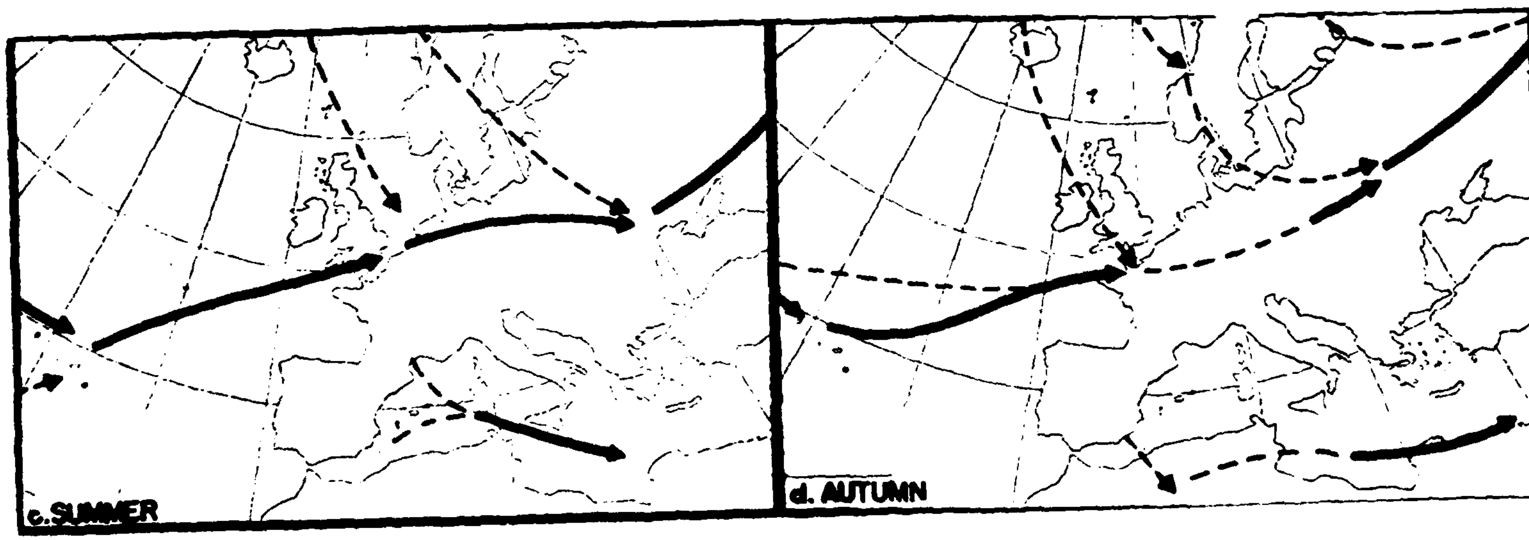


FIGURE 4-15 COMPARISON OF ANTICYCLONE PATHS

e. Whereas spring is a season of extensive shower activity, autumn becomes a season of extensive stratus and rain. Increasing cloudiness and loss of insolation begin cooling the land masses and by late October or early November the first snow has fallen bringing portents of winter.

f. The difficulty in forecasting autumn weather like spring, is in the mixing of intruding winter like weather systems during the latter part of the season. There is little difference between autumn and winter in the mean positions of the polar or subtropical jet streams, and as the Azores high decreases in intensity more and more Atlantic systems are allowed to invade the continent and conditions generally deteriorate until the icy fingers of winter become the controlling influence.

4-8 Severe Weather

a. The forecasting of severe weather is normally not a serious problem at Ramstein. Severe weather is pretty much limited to thunderstorms during the warm season, which imply severe turbulence and icing by definition and to winter situations of icing and turbulence.

b. Forecasting thunderstorms in Germany is basically not any different from forecasting thunderstorms in the United States. In Europe however, the lack of a large continental area decreases the frequency of air mass thunderstorms so that most storms at Ramstein are frontal even in the middle of summer. This is in part due to the fact that frontal systems do migrate through the area the year round and the maritime tropical air rarely achieves outstanding potential by stagnation. Further, the Pyrenees and Alps tend to restrict the amount of maritime tropical air that flows into the Ramstein area from the Mediterranean. The only route available is up the Rhone valley into the Saar valley and eventually up to Ramstein. A second source region of mT air is the Atlantic ocean. A southwesterly flow advecting mT air off the Atlantic is a good bet for some convective activity and at least isolated thunderstorms if the air retains enough moisture by the time it arrives at Ramstein. If the flow is associated with a frontal system or migrating low the possibility for numerous or even lines of thunderstorms increases greatly.

c. One situation that affects thunderstorm development over France and Germany is a subtle but definite cyclogenetic - frontogenetic process which begins in Spain and intensifies over France as it moves northeastward. The pressure pattern presents a weak or weakening ridge of high pressure over France and Germany close analysis will reveal an old quasistationary, inactive frontal structure across Spain and southern France, cool maritime air to the west, and quite warm air over Spain and southern France. A thermal low first develops over Spain and later develops over France. As the wave cyclone develops, more warm air is injected from the south, and the cold coastal air activates the cold front. The perturbation then begins to move toward the northeast. In some instances a strong polar front in the Atlantic will overtake the cyclone resulting in an intense front with severe thunderstorms. A study of the synoptic situations during the summer of 1958 reveals that in a three month period this situation occurred ten times. The first thunderstorm activity can usually be detected over northwestern Spain and may then be followed in the mean southwesterly stream for at least 48 hours. Figures 4-15 a through d show an example of this type of situation. The 850-mb isotherm pattern has been included to support the analysis and demonstrate the extreme usefulness of the 850-mb chart in synoptic analysis over western Europe.

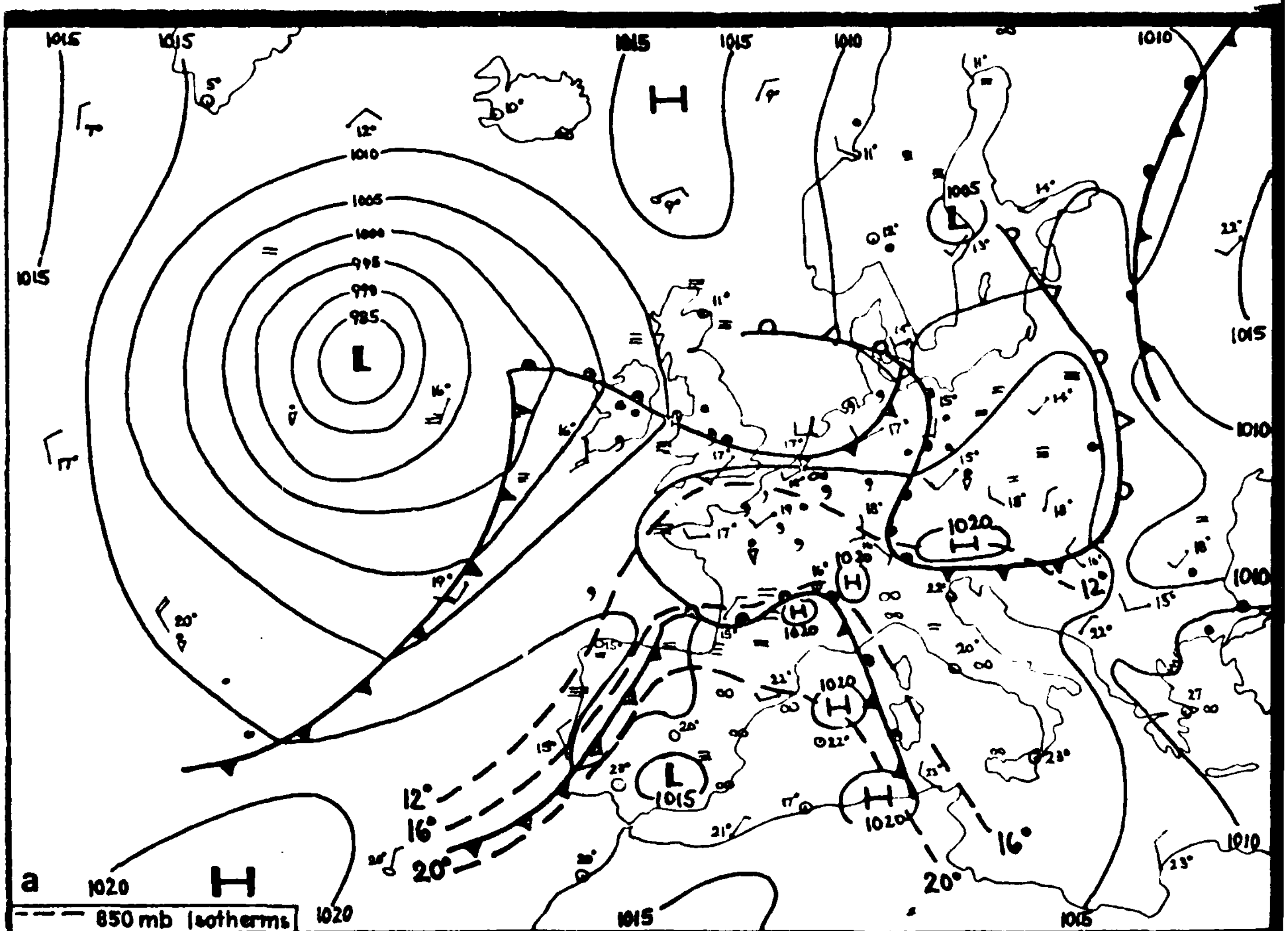


FIGURE 4-15A EXAMPLE OF SUMERTIME CYCLOGENESIS AND FRONTOGENESIS OVER SPAIN AND WESTERN FRANCE, 0600 GMT 9 AUGUST 1968

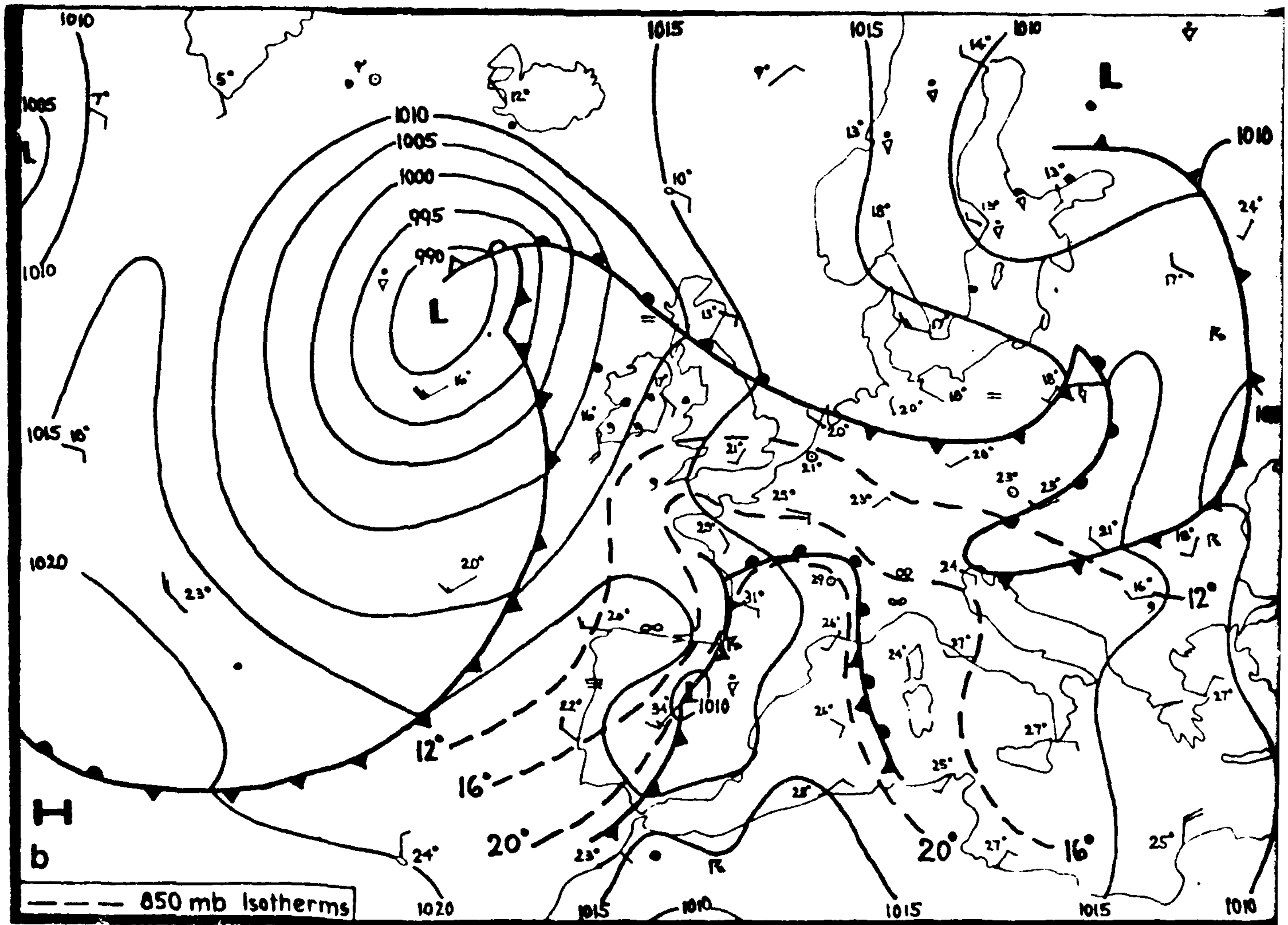


FIGURE 4-15B CONTINUED, 1800 GMT 9 AUGUST 1958

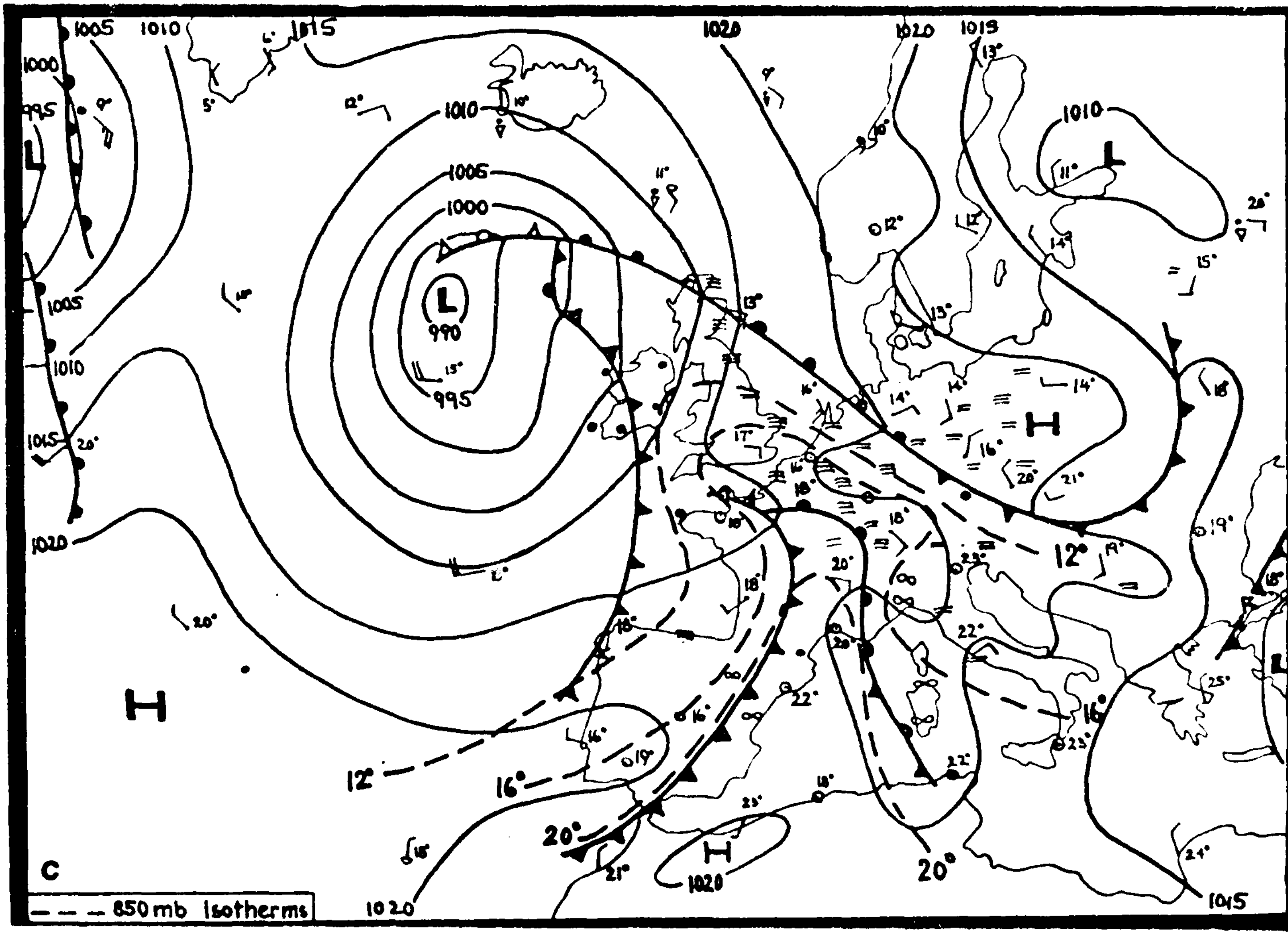


FIGURE 4-15C CONTINUED, 0600 GMT 10 AUGUST 1958

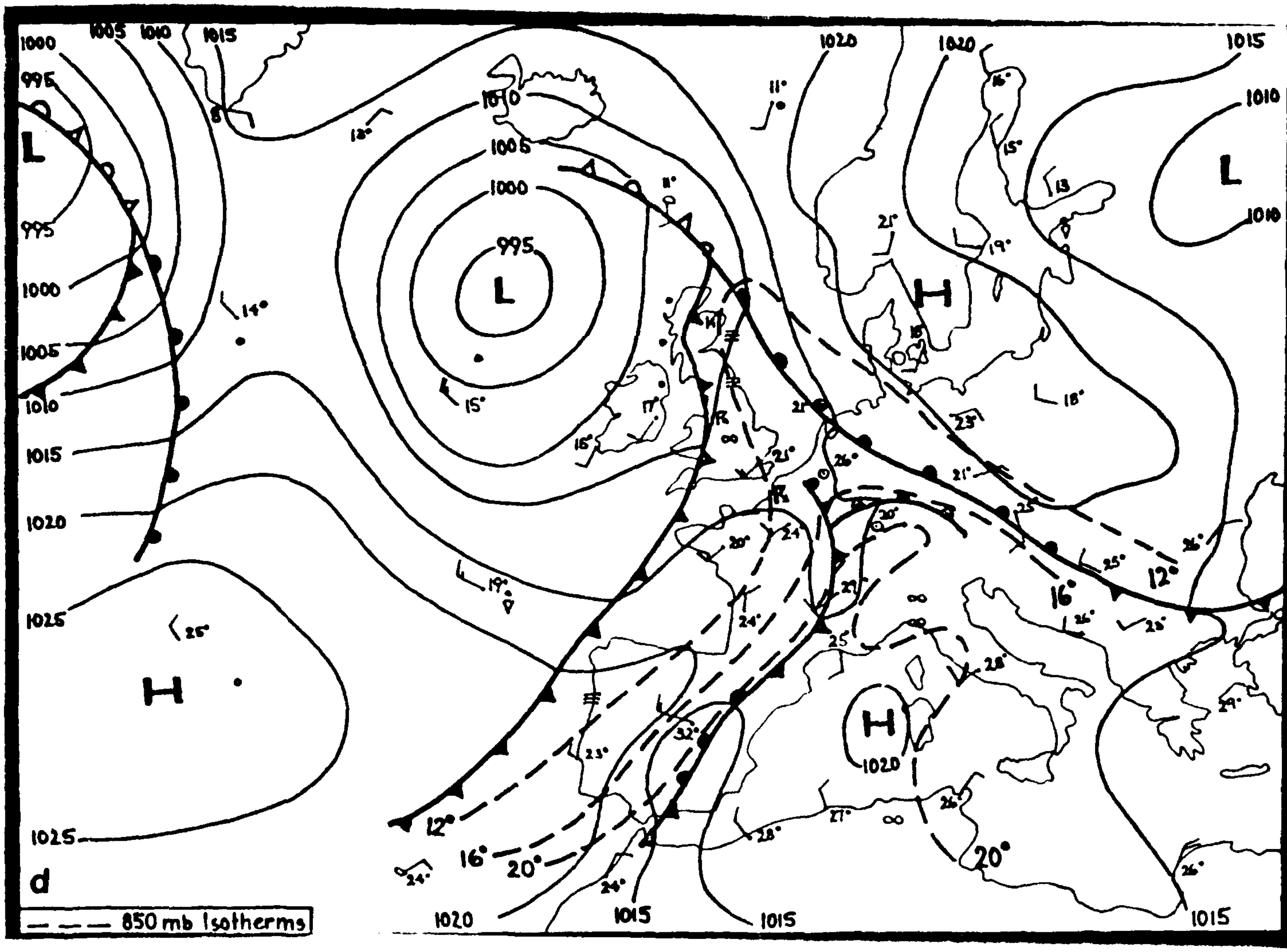


FIGURE 4-15D CONTINUED, 1800 GMT 10 AUGUST 1958

d. One of the handicaps encountered in forecasting thunderstorms at Ramstein is that there are no close radiosonde stations to the west or southwest. The closest station to the SW is Nancy France at a distance of about 65NM. Trappes/Paris is the only station to the west and is 200NM away. These stations are separated from Ramstein by ridges of 3000 feet, so the moisture content in the low levels differs considerably on many occasions. The closest station to Ramstein is Idar-Oberstein about 20NM NNW and is in an entirely different valley system.

e. During the winter months, rime ice is liable to be encountered in stratocumulus although most of the time the intensity should be light. Occassionally, with a particularly strong front, a cumulus cloud embeded in the stratocumulus will cause moderate rime icing and some clear icing may be encountered. A great deal of caution must be exercised in winter when clearing aircraft for a flight below a warm front. Generally the rain falling from the warm front into the cold air below will change to freezing rain or drizzle once into the cold air. This situation is quite common in late fall, winter and early spring as an occlusion approaches the station from the west, or when warm air is over-riding a stagnant dome of cold air trapped in the valley.

f. The occurrence of high winds and turbulence during the winter is not uncommon at Ramstein, however the potential for severe criteria is limited to a few synoptic situations. Tight gradients are most often the cause of severe turbulence during the winter. Low level jets of 60-80 knots have been reported as low as 3000 to 5000 feet. These gradients are most often associated with a fast moving low which rapidly deepens across France as it approaches Ramstein. Normally unless the central pressure of the disturbance is less than 1000 mb the maximum wind is experienced between the warm front and the cold front and will blow from 190-250 degrees due to the channel effect of the valley. Generally if the centeral pressure is less than 1000 mb this channel effect is diminished and maximum gusts are likely to occur from 180° to 360°.

g. Another situation is a deep low center in the North Sea that reaches to the tropopause. A tight westerly gradient may develop giving wind speeds up to 30 knots with gusts to 45.

h. Clear air turbulence has occurred at or just below the tropopause in many cases where a very sharp tropopause break is evident. Frontal turbulence or turbulence in clouds during the winter is generally only light to moderate in as much as there is no real sha[illegible] contrast in air masses. The usual overrunning tends to give only a large scale type of vertical motion with very low vertical velocities. At any time of the year Ramstein AB may experience moderate to severe low level turbulence. Whenever the surface winds at Ramstein are from the southwest (190-230 degrees) and greater than 15 knots, moderate turbulence on final approach below 3000-4000 ft MSL will be encountered. The stronger and/or the more southerly the winds, the greater the turbulence. Usually the turbulence decreases just before touch-down.